The New Zealand
Journal of Agriculture.

VOL. 41. WELLINGTON, 20TH DECEMBER, 1930. No. 6

STRAIN INVESTIGATION OF GRASSES AND CLOVERS.

(Continued.)

E. BRUCE LEVY, Agrostologist, and WM. DAVIES*, Plant Geneticist, Plant Research Station, Palmerston North.

3. RED CLOVER (Trifolium pratense).

RED clover occupies an important place in grass-farming the world over, and the type now dominant in world markets would indicate its greatest function to be in temporary and short-rotation pastures. For purely temporary pasture work rapid-establishing and high-producing but short-lived types of red clover have been evolved, and for the temporary pasture this type is what is required. The South European, French, and Chilean red clover on the market are of this type, and are suitable only for one-year pastures. For the short-rotation pasture of two- or three-year leas rapid establishment and quick production is similarly required, but there is not quite the same call for rapidity of establishment.

The typical broad red clover has apparently been evolved under years of short-rotational farming. All New Zealand red clover is essentially of this normal broad red type, although there are indications that New Zealand Broad Red is slightly longer-lived than the ordinary European red clover of this type. Our trials in New Zealand and those at Aberystwyth, Wales, however, would indicate that New Zealand Broad Red and the English Broad Red are almost identical in type. The point, however, that we wish to make perfectly clear is that broad red clover the world over is characteristically a short-lived type evolved under a short-rotation system of farming. For such conditions one does not require high persistency, but moderately quick establishment; early spring growth, heavy hay-yields, and good summer aftermath production are essentials. Such pastures are regarded more or less purely as supplementary feed crops and as an integral part of rotational farming.

Nowadays, however, with high renewal costs and the ever-increasing practice of top-dressing, the trend is definitely for long-rotation and truly permanent pasture. The big question before the research worker is whether he can produce and make available to the grassland farmer

* Member of staff of Welsh Plant Breeding Station, Aberystwyth, seconded to Plant Research Station, Palmerston North.

a red clover that can take its place and hold it indefinitely in a mixed sward of rye-grass, cocksfoot, timothy, crested dogstail, white clover, &c. There is a place for a red clover in the permanent pasture, but it must be a type that will persist and blend in with the other dominant species. The broad red sown to-day is in many respects dangerous to include in a permanent sowing. It establishes rapidly, and produces in the first year an enormous bulk of herbage that quite overshadows and smothers much of the truly permanent elements such as perennial rye-grass, crested dogstail, white clover, &c.; then in the second year its yield rapidly falls off, the plants die, and a weak, open, poorly constituted pasture is left to carry on. An ideal permanent-pasture red clover should not establish more rapidly than the other constituents of the mixture, and it should blend in and harmonize with these other constituents, yielding a seasonal quota of feed when the other species are at a low stage in production.

It may be asked for what period of the year is red clover desired in the pasture. We are of the opinion that red clover will best fit in during that period from the falling-off of the rye-grass and white clover shortly after December until the recovery of these when the weather has definitely broken in the autumn. In this critical period red clover should fit in together with cocksfoot or paspalum. The extra-late-flowering red clover types, such as Montgomery or Cornish Marl, are more likely to fill this role than any early-flowering type such as the ordinary broad red clover. The Montgomery Red, with its lower-set and more densely tillered crown, is structurally more fitted to persist under grazing conditions than the open-crowned, few-tillered broad red types. Finally, it would appear that if a red clover is ever to be introduced into our permanent pastures the hope of success lies very much more definitely in Montgomery Red than in any other type, and the trials in New Zealand with this clover up to the present would certainly indicate that some measure of success in this is assured.

Another important point to bear in mind is the need to cater for export requirements. Great Britain is probably our greatest potential buyer of red-clover seed, and her requirement for a persistent red clover is more specific than our own. In New Zealand, with its milder winters and autumns that favour comparatively easy re-establishment from seed shed, persistent strains would appear to be less absolutely essential. In Great Britain, particularly in Western and Northern districts, there is less chance of autumn re-establishment and a greater degree of winter killing than with us; highly persistent, truly permanent types are what Britain is likely to demand in the near future. The once-growing in New Zealand of the Montgomery Red type, and the export of this to Great Britain, would greatly help to consolidate the red-clover-seed trade between the two countries.

We do not advocate abandoning the growing of broad red clover in New Zealand, but rather of adding Montgomery Red as a special type, keeping in mind always that as the world demand for a truly permanent red clover expands so should our crops of this increase in order to cater for that demand.

Red clover is a particularly interesting species, and provides an example of how environment, natural or modified to suit human purpose, selects out the type best fitted to survive for the particular end

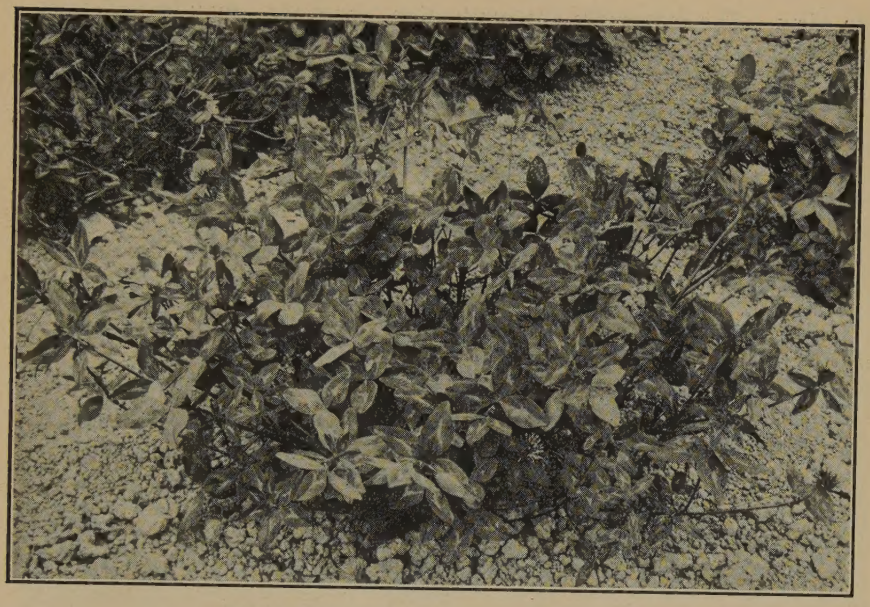


FIG. 1. NEW ZEALAND BROAD RED CLOVER.

Single plant, showing lax and stemmy growth, with general openness of crown. Age, six months. Early-flowering in comparison with Figs. 3 and 4.

FIG. 2. NEW ZEALAND BROAD RED CLOVER.

Single plant, showing denser crown and less proneness to stem and early-flower production. Age, six months. Best broad red plant in experiment.

[*Photos by H. Drake.*

in view. The extremely low-production, prostrate, small-leaved, wiry-stemmed wild forms are the outcome of an environment peculiar to the very old pastures of Great Britain. Montgomery Red and Cornish Marl are types cultivated respectively in the long-rotation pastures of certain parts of Montgomeryshire and Cornwall. The late red group, as represented by Hersnap and Altaswede, are intermediate between Montgomery and typical broad red, and, judging from their behaviour in New Zealand, are intermediate in demand of environment between these two major groups. The broad red is plainly the outcome of arable and short-rotation farming, where the more tardy establishers and lower early-yielders are rapidly eliminated, either by the smother or by the fact that their seed does not ripen simultaneously. The extreme broad red type is represented by certain French, Chilean, and Italian types, such as Lombardy red clover. This latter type was the first to establish in our trials, and during the first year it was always ahead of any other type. In the second year, however, it failed badly, and was the first to go out under our mowing trials.

In the hands of a skilled plant-breeder it would appear that a red clover for any soil and condition could ultimately be evolved, and while many types may be useless as competitors with species already filling a definite role in our grasslands there are still unfilled places that could well be filled by certain types of red clover.

Major Types of Red Clover compared.

Red clover surveyed as a species falls into four main groups: Broad red, late red, extra late red, and wild red. It will be convenient to discuss briefly in the light of overseas experience each of these four main types.

BROAD RED CLOVER.

This type is also called early-flowering red clover, cow-grass, and double-cut cow-grass. The broad red group is the least persistent of all the red clovers; it grows rapidly from seed and tends to produce excessive smother during the early growth periods. This early smother by broad red is certainly limiting the use of red clover in many parts of New Zealand, where the successful establishment of permanent grass is the objective, and where it is therefore essential that excessive smother by any one species shall not take place.

Broad red clover flowers earlier in the season than late red clover, but normally little or no seed is set in the early part of the season, due largely to absence of humble bees at this period. A second crop of flowers is produced in early autumn, when seed is set in abundance, and it is at this time that the seed crop is taken in practice.

The average type of plant common in broad red clovers is typically lax at the crown at all stages of growth, relatively few-tillered, and producing stem rather than leafy growth, especially at mid-season (see Figs. 1 and 2). This inherent laxity in growth-form of the plant in broad red becomes apparent in quite early seedling stages, and can at that time be made use of as one of the diagnostic characters distinguishing the broad from the late-flowering red clovers. New Zealand red clover is characteristically a broad red clover.

FIG. 3. LATE RED CLOVER.

Single plant ex line Altaswede, showing denser and more leafy growth. Age, six months. Plant not yet commenced to flower.

FIG. 4. LATE RED CLOVER.

Single plant ex line Altaswede, showing dense dome form. Age, six months. This type showed virtually no winter growth in 1930.

[*Photos by H. Drake.*

ORDINARY LATE-FLOWERING RED CLOVER.

Ordinary English late, Swedish late, Danish, and other North European and North American lates come into this group. A few plants in some lines of New Zealand red clover can probably be best placed in this group, but on the whole the Dominion's red clover is typical broad red. Late red clover normally flowers rather later in the season than broad red and is more persistent, lasting two to three seasons in Britain as against one to two seasons in the case of the broad red.

Late-flowering red clover plants when studied individually are fairly dense at the crown, and tiller better than the broad reds. Normally only one full crop of bloom is produced per annum. If allowed to mature at mid-season a second crop of flowers is not produced; but if grazed late into spring the flowering period is delayed, and this course is the normal practice when the crop is grown for seed. The leafy rather than the stemmy aftermath makes late-flowering red clover a better grazing-plant than broad red from mid-season onwards. Types of plants common in ordinary commercial lines of late red clover are shown in Figs. 3 and 4, but most samples of seed contain small proportions of plants belonging to broad red.

EXTRA-LATE-FLOWERING RED CLOVER.

There are two well-defined commercial strains belonging to this group—the true Montgomery and the true Cornish Marl red clovers. Both of these are British local varieties, the former long cultivated in the Welshpool district of Montgomeryshire on the English-Welsh borders; Cornish Marl is similarly largely localized to the Wadebridge district of North Cornwall. These varieties are closely allied the one to the other. A few plants found in certain Scandinavian and Russian late reds closely resemble the Montgomery-Cornish Marl type in growth-form. Extra late red as a group is considerably more persistent than either of the two first groups discussed and is a more promising pasture type for New Zealand conditions, apparently being much more persistent here than in Britain. The type of plant predominating in this group may be judged from Figs. 5 and 6, though there is considerable variation between individuals in any given line. The type is slower to establish from seed than either broad or ordinary late red, and therefore does not produce that rapid flush of seedling growth so characteristic of the former. The English experience is that the mid-season growth is heavier in Montgomery Red than in broad red.

Only one crop of flowers is produced during the year; an area designed for seed must therefore be grazed until early summer and the seed crop taken in the autumn at the usual time.

ENGLISH WILD RED CLOVER.

Seed of this type is commercially available in England to a limited extent. It is there indigenous to very old grasslands, but the type does not appear to have reached New Zealand in any quantity — at least, it has not become established as a constituent of old pastures in this country.

As might be expected, wild red clover is an exceedingly heterogeneous group. As a whole, the type is low in total production and extremely

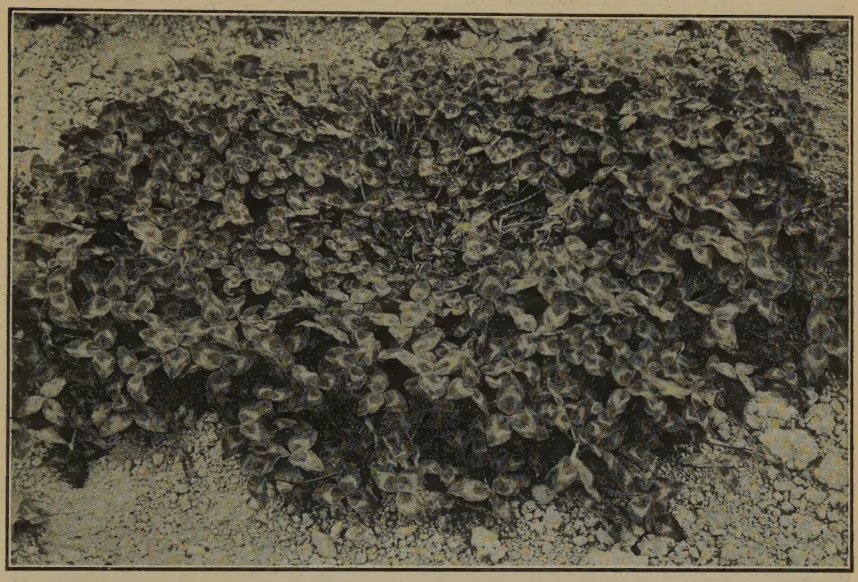


FIG. 5. EXTRA LATE RED CLOVER, MONTGOMERY TYPE.

Single plant, showing prostrate dense leafy growth, and low-set many-tillered crown. Age, six months. This type is highly persistent and best suited for permanent-pasture sowings.

FIG. 6. EXTRA LATE RED CLOVER, MONTGOMERY TYPE.

Single plant, showing slightly laxer form, and not quite so dense as Fig. 5. Age, six months.

[*Photos by H. Drake.*

variable in time of flowering, persistency, growth-form, and leafiness. Many of the forms tend to be very dense though diminutive plants, and it may be possible to isolate types to fill special requirements as, for example, for use on hard sheep-country.* It may also well be that very highly persistent forms of wild red exist, and that these can be used for crossing with cultivated varieties with a view to increasing the persistency of the latter. Extended trial of this type in New Zealand is a project which the Plant Research Station has in hand.

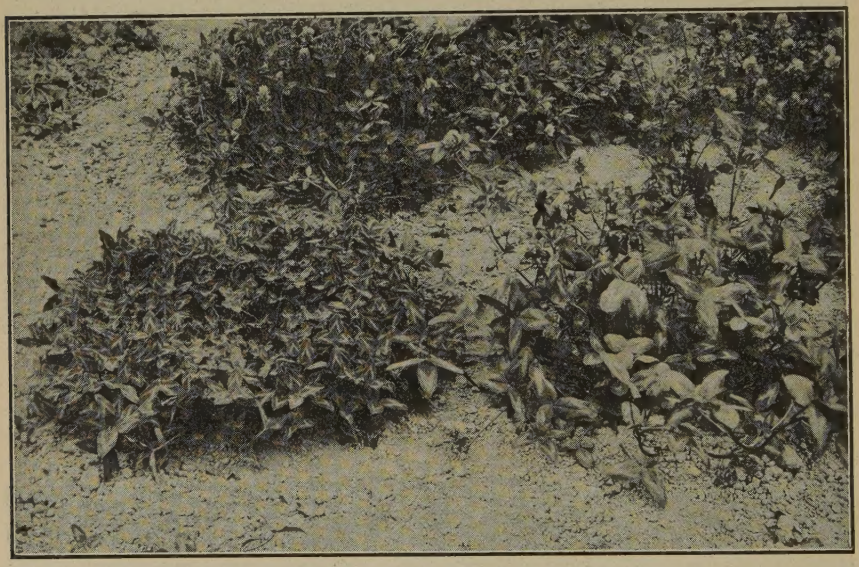


FIG. 7. EXTRA LATE RED CLOVER (ON LEFT) AND BROAD RED CLOVER (ON RIGHT) GROWN SIDE BY SIDE.

These plants show the difference in growth-form and type between these two major groups. Age, six months.

[*Photo by H. Drake.*

Red Clover Trials conducted at the Plant Research Station.

Three series of trials have been initiated at the Station in connection with strain studies in red clover. These are as follows :—

(1) Broadcast plot trials at the Station area and under normal grazing in the field (the latter in conjunction with the Fields Division). These trials are supplemented by additional trials laid down by Mr. J. W. Deem at the Marton Experimental Area during the period 1926 onwards.

(2) Spaced-plant studies at the Station area, laid down during the past eighteen months.

* In this connection it may be of interest to refer to experiments conducted on the property of Mr. S. M. Bligh, Cilmery, Wales, and with which one of the writers was concerned. These showed that wild red clover responded to phosphates to a remarkable degree and considerably assisted in the improvement and cropping-capacity of the sward.

(3) Intensive trials with specific growth-forms of red clover, with a view to defining with some degree of accuracy which types of plants, irrespective of their country of origin, are likely to be most useful under New Zealand conditions. These trials have been designed under a triple system of management, and, since they have only recently been started, no useful report can yet be made, and no further reference is made to them in this article.

(1) Broadcast Plots.

The broadcast plot trials at the Plant Research Station were sown in spring of 1928 in duplicate, the plots being approximately $\frac{1}{1300}$ acre. Sixty-five lines of specific New Zealand origin were dealt with, and an additional thirty-nine lots of red clover from overseas. The overseas lines included lots from various English counties, from Canada, United States, Chile, Italy, Poland, Russia, Czecho-Slovakia, Switzerland, France, Norway, and Sweden, as well as defined types from the Welsh Plant Breeding Station, Aberystwyth. After the plants were properly established the plots were each divided transversely into two sections; one section was cut weekly with a lawn-mower, the second section was under a system of infrequent cutting, being tantamount to young hay or ensilage. No reseeding was allowed to take place on any of the plots. Observations and notes were made at intervals, but no weights were taken. The state of fertility was kept at a fairly high standard throughout the experiment by means of fairly frequent dressings of superphosphate and ammonium sulphate. Analysis of the swards by the point-quadrat method was made when the plots were nine months down, and again exactly a year later.* The observations made on the plots confirm in general the results obtained by overseas workers in red clover variety trials.†

Behaviour of the Various Groups, Seasons 1928–1930.

Broad Red.—Under drastic (= weekly) cutting with a lawn-mower the broad reds more or less completely disappeared in about six months after the commencement of this treatment. The lots of ordinary late-flowering persisted considerably better, even after twelve months' cutting, but these did not show nearly as good persistency as the Montgomery and Cornish Marl strains (see Table 1). The number of oft-repeated cuttings which a plant or group of plants can withstand is in direct ratio to the relative persistency of those plants. Thus the type that can stand up to and persist longest under a system of weekly cutting is likely to prove the most persistent under any given system of grazing or depasturing.

Under "hay" conditions (= infrequent cutting) the broad reds have persisted quite well and have yielded to date better than any other clover type under trial. (Table 2.)

The one striking exception is a line of Italian broad red clover, which is now thinning out very rapidly (two years after sowing) and is apparently not likely to hold much longer even under the most lenient

* All point-quadrat analyses made by Mr. E. A. Madden, Assistant in Agrostology.

† For summary of position in Britain and for a wide range of references to other workers in this subject see R. D. Williams, Red Clover Investigations, Bull. H. No. 7, Welsh Plant Breeding Station, Aberystwyth, Wales, 1927.

cutting. Under weekly cutting this line was the first broad red to be killed outright. These results are confirmatory of the British and American work, which showed Italian red clover to be the least persistent of commercial reds in those countries. French, Chilean, and Swiss Mountain red clovers are all thinning out considerably on the hay plots (third spring), while New Zealand, English, Canadian, and Czecho-Slovakian broad reds are all apparently lasting well and show but little signs of weakening in the hay plots. All the broad reds have more or less completely disappeared in the " weekly cut " sections.

Productivity in the broad reds has been satisfactory during the period under review. They have made some winter growth over the two seasons, Italian red being of outstanding merit in this respect during its first winter and also during the first part of the second winter. Growth in the broad reds, however, was always lax and tall rather than dense and short, while during mid-season there was a proneness to stem-production and a consequent reduction in production of leafage.

Ordinary Late Red.—This group was more persistent under weekly cutting than the broad red group. In the hay plots it persisted well to the end of the second year (end of first harvest year) without any show of thinning out. In production the lates up to the present have not equalled broad red. As broadcast plots the former were never completely dormant, although as single plants two lines of ordinary late-flowering—Swedish Hersnap and Canadian Altaswede—were completely winter dormant and did not make early spring growth, being surpassed in this latter respect both by New Zealand red and Montgomery and Cornish Marl reds. Swedish Hersnap and Canadian Altaswede, however, are persisting better in the third year than the ordinary late reds, approaching in this respect closer to the extra late red type.

Extra Late Red.—These types proved considerably more persistent than either late red or broad red under the system of weekly cutting. Montgomery and Cornish Marl reds have persisted well in the hay plots, at all times giving a dense cover of close-growing leafage. The yield under hay, however, has for the two years down been less than in normal broad red. Spring growth in the extra late types did not commence in our trials at the Station before the beginning of October, whereas New Zealand broad red started growing in early September—a month before.

At the Marton Experimental Area Montgomery and Cornish Marl red clover sown in 1926 in a mixture with other grasses and clovers and subjected to normal management in the field have persisted very well (four years), while the control plots sown with New Zealand and with imported broad red had completely died off by the autumn of 1929 (two years and a half after seeding). Under very close and intensive grazing with sheep on the same field none of the red clovers lasted as long as where grazing was less severe; but here again Montgomery Red has persisted better and for a longer period than any of the broad reds. Recent point-analyses of these plots show total death of all broad red lots, while Montgomery Red and Cornish Marl were at the time of analysis constituting over 10 per cent. of the pasture.

Wild Red.—Only one sample of English wild red clover was tested in the 1928 broadcast trials. This line proved to be low in production

at all times during the experiment, formed a dense prostrate plant with dark-green foliage, and flowered abundantly at mid-season even in the weekly-mown section. The flowers were decumbent, being produced almost at ground-level. This line did not show a high degree of persistency, but the few plants that have persisted are very dense and healthy. This type may have a limited scope on hill country and land too hard for other types of red clover to hold on.

Table 1.—Relative Persistency of Red Clover Types at Plant Research Station Area, sown November, 1928. (Plots two years old.)

Extra lates = 100 in all cases.

Type.	Pasture = Weekly Cut.		"Hay."
	Estimation Method—Basis 0–10.	Point-quadrat Method.	Point-quadrat Method.
Extra late red	100	100	100
Ordinary late red	43	43	101
New Zealand broad red ..	10	16	86
English broad red	8		
Italian broad red	0	16	87
Other broad reds	3		

Table 2.—Relative Production of Red Clover Types at Plant Research Station Area, sown November, 1928. ("Hay" Plots.)

Broad reds = 100 in all cases.

Type.	First Spring (9/10/29).	Second Autumn (26/5/30).
New Zealand broad red (sixty-five lines) ..	100	100
Imported broad red (nineteen lines) ..	100	109
Imported late red (fourteen lines) ..	88	54
Extra late Montgomery and Cornish Marl red (five lines)	87	69

(2) Spaced Plants.

Some 4,500 single plants are under close observation at the Station, and these make a very interesting study in relation to type and growth-form. Among all varieties there is considerable variation, and quite big possibilites for improvement by selecting and culling are manifest in any of the lots under trial. Perhaps the varieties offering the greatest possibilities in this direction are the extra late Montgomery and Cornish Marl. The commercial lines of these at present offering show marked variation, and while in the aggregate the type is distinct from any of the other major types, yet within the varieties there are possibilities of building by selection and culling to several main types. Before much work on type-building is done, however, much preliminary testing is necessary to learn which form best suits the purpose we have in view—that is, which form of Montgomery Red will persist best, and blend in and harmonize with the other major constituents of the permanent pasture.

PASTURE TOP-DRESSING IN CANTERBURY.

EXPERIMENTAL WORK BY THE FIELDS DIVISION.

(Continued.)

A. W. HUDSON, Crop Experimentalist, Plant Research Station, and
A. Y. MONTGOMERY, Assistant Crop Experimentalist.

PART III.—OBSERVATIONAL EXPERIMENTS ON BANKS PENINSULA, 1927–1930.

THE series of experiments here described was inaugurated in 1927 by Mr. J. W. Hadfield, Agronomist, Plant Research Station (then Instructor in Agriculture, Christchurch), and the present senior writer.

Largely owing to their somewhat isolated position and the cost of transporting manures, very few farmers on Banks Peninsula had attempted top-dressing. On account of cost of harvesting, cooksfoot-seed production is becoming relatively less important as an industry,

FIG. 12. MAP OF SECTION 5, SHOWING LOCATION OF EXPERIMENTS ON BANKS PENINSULA.

Each experiment is represented by a numbered dot.

and is giving further place to pastoral farming. Under the changing conditions of management the deterioration of pastures is making itself very apparent. With a view to getting a lead regarding the most useful lime or fertilizer applications to check this deterioration a series of observational experiments was laid down on different pasture types which were fairly representative of the Peninsula as a whole.

The soils of the Peninsula are mainly of volcanic origin, except on the western slopes, where a covering of wind-borne material (loess) is found.

Ten experiments were laid down, as shown in the accompanying map. The treatments in each case were as follows, the amounts being per acre in each case :—

(1) No manure.
(2) Superphosphate, 3 cwt.
(3) Basic slag, 3 cwt.
(4) Basic superphosphate, 3 cwt.
(5) Ephos phosphate, 3 cwt.
(6) 30-per-cent. potash salts, 2 cwt.
(7) Superphosphate, 3 cwt., plus 30-per-cent. potash salts, 2 cwt.
(8) Ground burnt lime, ½ ton.

All treatments were applied in the winter of 1927. Treatments 2 to 7 inclusive were redressed in 1928, 1929, and 1930. Burnt lime was used in Treatment 8 on account of transport costs. Treatments 1 to 7 crossed both limed and unlimed ground, as shown on the plan (Fig. 13).

Half the area was fenced from the rest of the paddock in each case, so that a complete set of treatments occurred inside the enclosure and a complete set outside. The enclosed portion was closed to facilitate observation, and in general the growth was cut for hay once each year

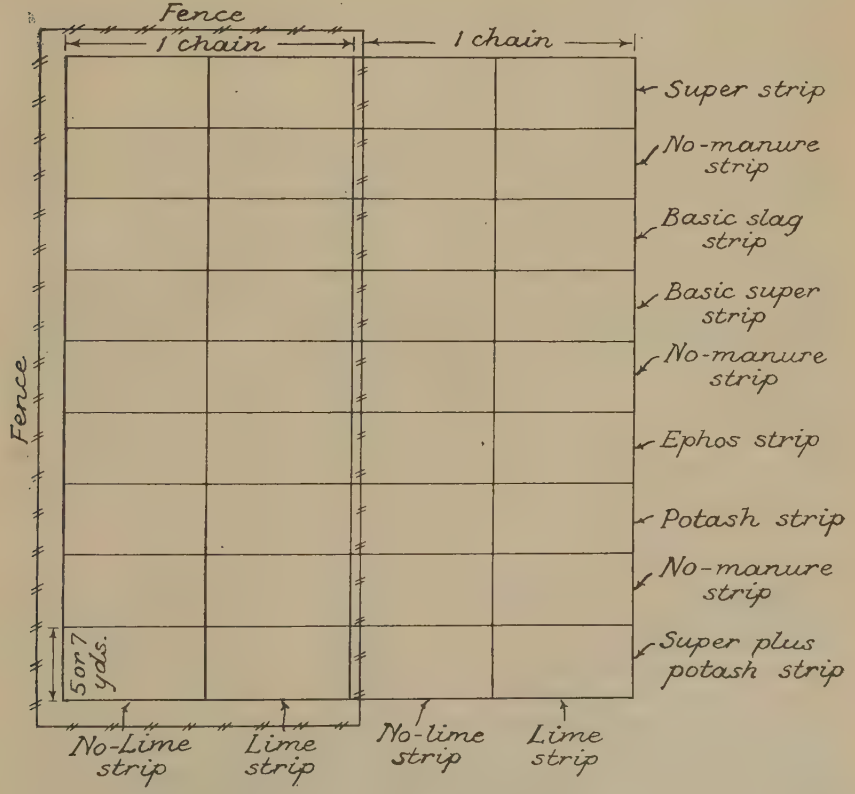


FIG. 13. PLAN OF STANDARD TOP-DRESSING EXPERIMENT LAID DOWN ON BANKS PENINSULA. (NOT TO SCALE.)

and grazed for the remainder of the season. In a few cases the enclosure was grazed only, on the system of intermittent grazing.

Notes on the Experiments.

1. FARM OF D. BARWICK

This farm is situated on part of the old Kinlock estate, on the drier country of the Peninsula, about 1,000 ft. above sea-level. The country is covered with tussock and associated grasses and clovers, chief of which are danthonia, cocksfoot, Yorkshire fog, rye-grass, goose-grass, hair-grass, and clustered, striated, white, and suckling clovers. The pasture on which the experiment was laid had been ploughed many years before and, with the exception of tussock and danthonia, contained most of the species mentioned.

Responses to Lime and Manures.—Lime gave a slight but definite result. All phosphates stimulated the growth of clovers, particularly white clover.

Although superphosphate showed the first slight response basic slag was most pronounced in its effect subsequently.

At times basic slag and Ephos phosphate were the best plots, while at other times slag and super showed a superiority. Both slag and super gave better results on limed than on unlimed ground. Potash did not cause any visible difference.

It is problematical whether top-dressing of this country will prove highly paying. If done systematically, and advantage is taken of the increased carrying-capacity, no loss should result, and deterioration will certainly be checked.

2. FARM OF D. RICHARDS, OKUTI VALLEY.

This experiment was on somewhat similar though slightly rougher country than No. 1, at an elevation of about 700 ft. The chief species present were Poa tussock, Yorkshire fog, cocksfoot, danthonia, sweet vernal, and a little rye-grass with white and suckling clovers. Some rushes and a little bracken-fern were also present.

Responses to Lime and Manures.—Lime caused a slight but unmistakable increase in clover-growth. The manures were slow to show improvement, but did so quite definitely. Basic slag was most effective. Ephos and basic super appeared to be slightly more effective than super. Potash had no visible effect. The remarks regarding the question whether manuring would be profitable made respecting No. 1 also apply to this experiment. Fern is troublesome on this area, however, and the assistance of top-dressing in stimulating pasture-growth as an aid in the crushing-out of the bracken is an added reason for careful consideration and trial of top-dressing.

3. FARM OF J. G. WALLER, OKUTI VALLEY.

This experiment is situated higher up the Okuti Valley than No. 2, at an elevation of about 800 ft. The main constituents of the pasture are danthonia, sweet vernal, fog, cocksfoot, suckling clover, hair-grass, and catsear, with some rye-grass. This country was covered with manuka-scrub in its natural state.

Responses to Lime and Manures.—Lime caused an unmistakable improvement in clover-growth. The responses to slag and Ephos were quite outstanding in the first season. Super and basic super were very little better than no manure. All manures except Ephos were better on limed than on unlimed ground; the reverse was the case with Ephos. Slag maintained its superiority throughout, although in 1929 super gave good results on limed ground particularly. The chief responses were from white and

suckling clovers, with a thickening of the grass sward. On the unfenced portion a small amount of bracken-fern was in evidence. There were indications that there was less on the manured plots than on the surrounding unmanured ground.

Top-dressing here with slag should be profitable, and should assist in the control of bracken-fern.

4. FARM OF W. H. MONTGOMERY.

This piece of country was in bush originally. The main pasture constituents were cocksfoot, dogstail, white clover, Yorkshire fog, and rye-grass. Danthonia, sweet vernal, brown-top, and catsear were most in evidence on small dry knolls.

Responses to Lime and Manures.—Lime caused a definite though slight improvement in clover and the sward was generally better grazed. Super on limed ground was easily the best treatment during the first year. All phosphates except Ephos gave good results, however. Subsequently Ephos gave good results, but super and slag on limed ground have been consistently the best since the first season. On the unfenced portion, which was fairly continuously grazed, stock showed a preference for the phosphated plots, especially where they crossed lime. White clover responded best in the early stages, but cocksfoot, dogstail, and rye-grass have all been strengthened by the phosphate dressings, the result being a good close turf with less "flat" weeds, danthonia, and brown-top on the manured plots. Potash had no appreciable effect, although in November, 1929, Mr. W. H. Montgomery was of the opinion that potash on the limed ground had a slight effect on clover-growth.

5. FARM OF T. L. F. KAY, DUVAUCHELLE BAY (ONAWE).

Originally in bush, the field on which this experiment was laid down had been ploughed fifteen to twenty years prior to starting the experiment. The pasture was a comparatively good one, with cocksfoot, dogstail, Yorkshire fog, Poa pratensis, rye-grass, white and suckling clovers, rib-grass, and catsear as the main constituents.

Responses to Lime and Manures.—Lime showed an early improvement on clover-growth. The response to super was outstanding, especially on limed ground, and stock showed a marked preference for the herbage on this plot (Fig. 14). All phosphates improved the clover-growth, super being outstanding, with slag a close second. Both super and slag were decidedly better on limed ground. Potash did not appear to have any effect, either alone or in combination with super.

There can be no doubt about top-dressing paying on this country. With improved management and utilization of grass farmers cannot afford not to top-dress with lime and super or lime and slag.

6. FARM OF T. WAKELIN, DUVAUCHELLE BAY.

This experiment was about a mile from the preceding one, on a more run-out pasture and at a slightly higher level. The country was in bush originally. Sweet vernal, Yorkshire fog, cocksfoot, dogstail, danthonia, white clover, rib-grass, and catsear were the main pasture constituents, with some rye-grass.

Responses to Lime and Manures.—Limed plots were better grazed and contained more clover than corresponding unlimed plots. Super showed the most rapid response in the first season, and was better grazed than the other plots (Fig. 15). Sweet vernal and Yorkshire fog seeded abundantly on the no-manure plots, but the plants were readily eaten on the super plots, and comparatively few seed-heads were allowed to develop. Ephos had little effect at first, and was poorer on limed than on unlimed ground.

Subsequently super plus potash, super, and slag were the best plots on limed ground, and slag and Ephos were best on unlimed ground. Super plus lime stimulated grasses as well as clovers.

Potash alone did not appear to have any effect, but the super-plus-potash plot on limed ground was very good. It is possible that the potash is having a slight effect. The remarks regarding the payable nature of manuring made on Experiment 5 also apply here.

7. FARM OF THE LATE A. W. ORME, ROBINSON'S BAY.

This experiment was laid down on country originally in bush. At the commencement of the trial the pasture was rather open; the main constituents were cocksfoot, rye-grass, dogstail, Yorkshire fog, sweet vernal, white clover, rib-grass, and catsear.

FIG. 14. EXPERIMENT ON FARM OF T. L. S. KAY, DUVAUCHELLE BAY (ONAWE).

Foreground, lime plus super; background, lime alone. The field had "got away" rather badly. Cows grazed the lime-plus-super plot very closely, the effect being visible from a great distance. Photo taken in January, 1928, six months after initial dressing of manures.

Responses to Lime and Manures.—The lime response was definite and greatly enhanced the responses from the phosphates. On limed ground super plus potash and super alone gave the best results the first season. Subsequently slag, Ephos, and basic super all gave good results, but super plus potash, super, and slag have been the best plots. On unlimed ground slag was superior to super in clover-growth after the first season. Potash alone was ineffective, but when used with super on limed ground the results indicate that potash has an effect.

Mr. Orme was a keen advocate of top-dressing, and had been proceeding with the practice gradually but systematically.

8. FARM OF T. MASEFIELD, AKAROA.

This experiment was laid down on a very dense sward of cocksfoot, rye-grass, dogstail, Yorkshire fog, sweet vernal, and white clover. The corner of the field selected had been used largely as a cattle camp and was in a state of high fertility. It was selected as being different from any other of the experiments, although not altogether typical of the field as a whole.

Responses to Lime and Manures.—The effects of treatments were never very definite in this area. Lime caused a slight improvement in clover-growth, and the phosphates caused slight clover responses at certain periods. Observation was made difficult because the area usually had much unconsumed herbage on it, chiefly due to the " camping " of stock in the past. The results were rather discouraging, although the phosphate plots on the unfenced portion, which was less affected by camping of stock, were slightly better grazed at times than the unmanured plots.

FIG. 15. EXPERIMENT ON FARM OF T. WAKELIN, DUVAUCHELLE BAY.

Left, super; right, no manure. Cows grazed the super plots much more closely. Sweet vernal and Yorkshire fog flower-heads were much in evidence on the no-manure plots. The strips were visible from the road, which can be seen in the background, at a distance of about half a mile. Photo taken in January, 1928, six months after initial application of manures.

Mr. Masefield had used manures previously, but with indifferent results, although he considers that lambs fatten more readily on phosphated pastures.

9. FARM OF A. HELPS, AKAROA.

The area selected is at an elevation of about 1,000 ft. on a south-west face. The pasture was dogstail dominant, with cocksfoot, sweet vernal, danthonia, some rye-grass, white and suckling clovers, and flat weeds. As a result of haying the enclosed area cocksfoot became quite prominent.

Responses to Lime and Manures.—Lime caused an improvement, rye-grass and clover being more prominent than on unlimed ground. Subsequently slag, super, and Ephos gave the best results, especially on

limed ground. At certain stages after the first year Ephos appeared superior to super, while at other stages the reverse was the case. In the main, basic super was not as effective as the other phosphates, although all phosphate plots were better grazed than no-manure outside the enclosure. Potash appeared to be ineffective.

Mr. Helps is adopting top-dressing on parts of his farm.

10. FARM OF F. C. NEWTON, AKAROA.

This experiment is at a higher level than any of the others, being about 1,500 ft. on a sunny face of the hill. The sward is dominantly cocksfoot and white clover, with some rye-grass and fog, flat weeds, and suckling clover.

Responses to Lime and Manures.—The whole area, including the enclosure, was usually closely grazed when visited in the early stages, and responses were difficult to detect. Subsequently, however, considerable improvement was observed in the clover-growth on the limed plots. Of the manures super, super plus potash, and slag were the best, causing a fair increase in white clover and cocksfoot growth, especially on limed ground.

Summary and General Conclusions.

Responses to lime and phosphate have been observed on all ten experiments; the lime enhancing the responses from the phosphates in all cases, except in the early stage, when Ephos on limed ground was slower in effect than Ephos on unlimed ground.

Superphosphate showed the earliest effect on all experiments except Nos. 2 and 3; in these cases basic slag was more effective. Generally speaking, super on limed ground was markedly superior to super on unlimed ground. In a number of cases slag produced a better clover-growth after the first year than super, but super had more effect on grass-growth, especially on limed ground.

Basic slag gave good results in most cases, and appeared to be equal to super in the second year, and in two cases was superior to super in the first season (Experiments 2 and 3). With the exception of these two cases there seems to be little general difference between super and slag. Both gave better results on limed than on unlimed ground.

Basic superphosphate was responsible for improved growth, but was never superior to super or slag, and often was less effective.

Ephos gave as good results as super and slag in a few cases, but, generally speaking, was slower to act. In Experiment 2 Ephos was decidedly better than super in the first year.

Potash has been consistently ineffective when used alone. When added to super the mixture did appear to give slightly better results than super alone in two experiments.

The highest responses were obtained on the lower and relatively better-class country on which Experiments 4, 5, 6, and 7 were situated. The use of super and slag in conjunction with lime will undoubtedly pay well on such country, provided better utilization of the resultant growth is practised. On account of transport costs burnt lime would be the more economical form to apply (11 cwt. of burnt lime is equal to 1 ton of carbonate of lime, approximately). The farmer who cannot afford as much as ½ ton per acre of burnt lime should endeavour to apply 4 cwt. or 5 cwt. per acre, repeating the lime application every two or three years.

Superphosphate will be most rapid in effect, generally speaking, but the claims of slag are exceedingly good, and, in the absence of ability to apply lime, may be a better form of phosphate than super. In any case slag could well replace super after the initial dressing.

Dressings should be made in the autumn—at any time in March or April or when the autumn rains can be anticipated, rather than in the winter or spring. The autumn application will assist winter and early spring carrying-capacity without unduly increasing early summer production. Spring application tends to give its maximum effect in the early summer, when there is usually an abundance of feed and any additional grass is likely to accentuate the waste which so often occurs at this time.

The costs of transport should not be a deterrent. Even at the absurd figure of £5 per ton (the actual cost would be less than half of this) for cartage and application, we are convinced that—on the high-response land, at least—top-dressing would pay.

Unfortunately, a good many farmers adopt the practice of selecting particularly bad parts of their farms or pastures on which to begin improvement by top-dressing. The idea is to even up their pastures and do away with the "eye-sores." Much better financial returns will be obtained from application of manures to pastures which still have a reasonable sole of grasses and clovers. Broadly speaking, the practice should be to top-dress the better pastures first and apply the increased returns to the subsequent improvement of the poorer pasture. Manuring does not create grasses and clovers, but will materially assist the production of these when they are already present in the sward.

RE-ESTABLISHMENT OF PASTURE.

A good deal of country on easy slopes and ridge tops could be ploughed and resown. Although this is perhaps the last thing the average Peninsula farmer would consider, there is no doubt that with the abandonment of cocksfoot-seed production and the adoption of more intensive grazing it would pay handsomely to resow with good strains of perennial rye-grass and cocksfoot, including also such species as crested dogstail, white clover, and Poa trivialis.

PRECAUTIONS IN STORAGE OF CHLORATES.

THE fire risk attaching to the storage of chlorates should be realized by farmers and others using sodium or calcium chlorate for weed-killing purposes. These materials evolve oxygen when heated, thus very much increasing the intensity of a possible fire. Boxes and bags which have contained these materials are also liable to be highly inflammable owing to impregnation.

The State Fire Office advises that chlorates (and all other oxidizing materials) should be stored in bins, preferably of concrete or brick; zinc should not be used. Containers which have held these materials should not be stored, but destroyed as soon as empty. Care should be taken to keep chlorates well away from such substances as starch, sugar, gum, sulphur, fertilizers containing blood and bone, mineral acids, and dust. Care should also be taken to keep floors clean and free from spilled chlorates, as friction may cause ignition.

PHOSPHATE LOADING AT NAURU ISLAND.

THE NEW CANTILEVER INSTALLATION.

ALBERT F. ELLIS, C.M.G., New Zealand Commissioner, British Phosphate Commission.

THE phosphate-shipping operations at Nauru probably constitute the most difficult problem to be dealt with there, being attended, as they are, with the necessity of laying deep-sea moorings for the vessels in about 200 fathoms (1,200 ft.) of water. This is owing to the fact that Nauru is practically a mountain with its top above sea-level. The sides descend at an angle of 45 degrees, consequently a vessel's anchors and chains are useless to her safety, as even when lowered they could not keep her from coming in on the reef. Moreover, the island is so small and isolated that there is no protection from the sea and swell of the open ocean, except when the wind blows off shore.

The only method of shipping phosphate at Nauru has hitherto been by lightering. A number of surf boats are used, carrying the phosphate in large baskets which are hove up by the vessel's winches and returned for refilling. Launches tow the lighters to and from the jetty to the vessel. Under ordinary good weather conditions the work goes well, as much as 2,000 tons in a day of two shifts being frequently shipped. This system is, however, a great strain on the organization, by reason of the large number of boatmen, launches, lighters, &c., employed; a considerable quantity of phosphate also is lost in shipment; and, moreover, the system does not permit of sufficiently fast shipping when really suitable weather is experienced.

In order to overcome these difficulties a system of mechanical loading has been installed by means of a cantilever with two swinging arms supporting rubber belt conveyors. The object of the double end is to enable a vessel when moored in position to take in cargo both in the forward and after holds, thus not requiring to shift her position until loaded.

Preparatory to shipment the phosphate is stored in the shore bin, having a capacity of 12,000 tons, and is removed from there by means of a rubber belt conveyor running in a tunnel the full length of the bin, thence up an inclined gallery, discharging its load of 500 tons per hour at the compensating hopper half-way along the cantilever. At this point the stream of phosphate is divided, and passes in galleries along the two swinging arms by two smaller conveyors. At the extreme end of each arm of the cantilever an extension boom can be run out, giving a further overhang. The conveyors discharge their load at the outer end of this extension boom, and the phosphate drops by a telescopic chute direct into the vessel's holds.

The entire plant is operated electrically, and is controlled from a small cabin at the end of each arm. An operator sitting there can swing the arm out over the vessel as soon as she is moored in position; other controls run out the extension boom, set the conveyors in motion, and open the doors of the compensating hopper; the phosphate then streams along to the vessel at the rate of 500 tons per hour. With

FIG. 1. PANORAMIC VIEW OF THE NAURU CANTILEVER, LOOKING SOUTH.

The 12,000-ton dry storage-bin is seen on left of picture. "Nauru Chief" in loading position at end of cantilever.

FIG. 2. "NAURU CHIEF" UNDER CANTILEVER LOADING PHOSPHATE INTO NO. 2 AND NO. 4 HOLDS.

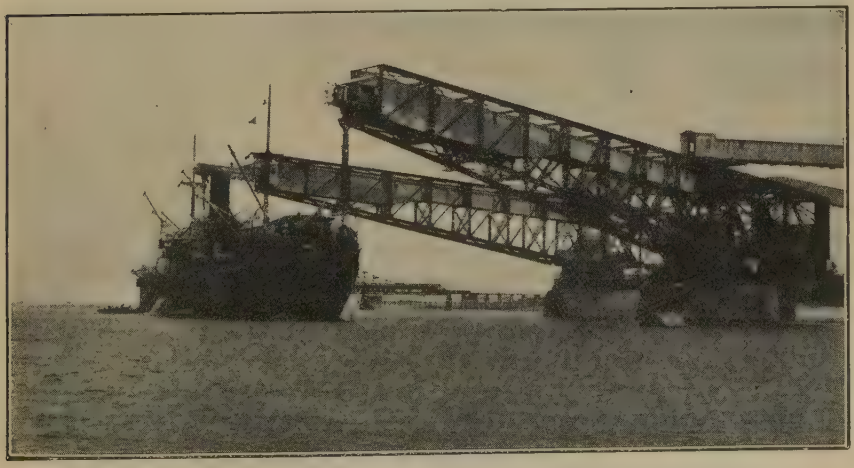


FIG. 3. VIEW OF CANTILEVER ARMS, LOOKING NORTH-EAST.

Showing north crane in loading position, and south crane being swung out over the "Nauru Chief." No. 2 jetty seen in distance.

this facility of control, loading can be stopped instantly, the extension boom run back, the arms swung round towards the shore, and the vessel left clear for putting to sea in a very few minutes.

The construction of the cantilever, which was supplied and erected by Messrs. Henry Simon, Ltd., of Manchester, England, occupied nearly three years. It was finished in October, and the system of moorings was also completed then. A few days later, fine weather permitted of a trial being held. The Commission's steamer "Nauru Chief," which had just completed the mooring work, was hove into position and there loaded all the phosphate she was able to take. The trial passed off very satisfactorily, and there is every reason to think the installation will prove successful for loading steamers of up to 7,000 tons capacity.

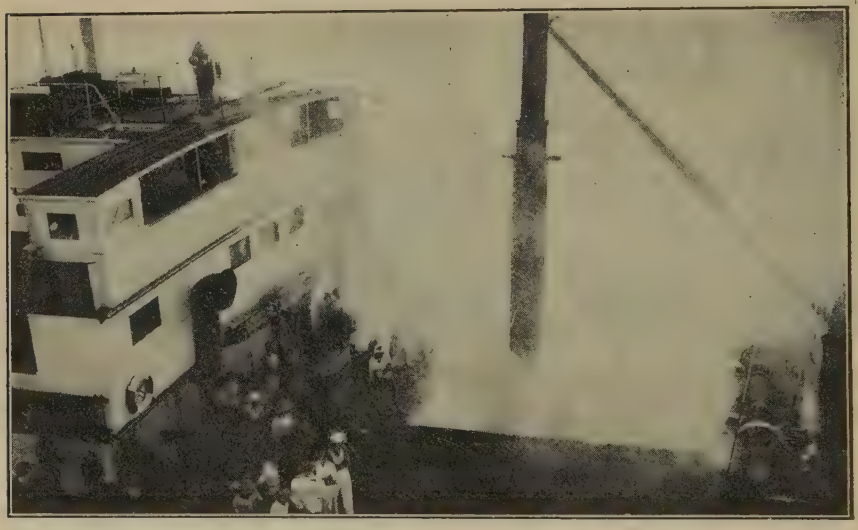


FIG. 4. THE FIRST PHOSPHATE LOADED DIRECT INTO SHIP'S HOLD AT NAURU.
Showing the telescopic chute of the north crane discharging into No. 2 hold of the "Nauru Chief."

It is obvious, however, that to moor a large steamer so close to the reef in unprotected waters entails a certain degree of risk, thus making it entirely a fine weather system of loading. Under suitable weather conditions the installation should be a labour-saving and expeditious method of doing the work.

In order to keep the cantilever fully supplied with ample stocks of phosphate ready for shipment, it will be necessary to further increase the crushing and artificial drying plant, the bin storage accommodation, railway-line extensions, &c. This will be done in due course, and these developments, together with others recently completed at Nauru and Ocean Islands, will place the industry in a much stronger position for meeting the phosphate requirements of New Zealand and Australia.

FARMERS' FIELD COMPETITIONS.

TARANAKI, WELLINGTON, AND HAWKE'S BAY DISTRICTS, SEASON 1929–30.

R. P. CONNELL, Fields Division, Department of Agriculture, Palmerston North.

IN the Taranaki, Wellington, and Hawke's Bay Provinces farmers' field competitions were conducted last season on the same general lines as have been followed for some years. That the competitions continue to be popular in these districts, where their value has been most thoroughly tested, is indicated by the total number of entries judged during recent years: 1926–27, 268; 1927–28, 370; 1928–29, 503; 1929–30, 523. The entries judged in the different districts were as follows, last year's figures being given in parentheses: North Taranaki, 327 (345); South Taranaki, 143 (96); Wanganui, 32 (20); Feilding, 11 (15); Hawke's Bay, 6 (13); Wairarapa, 4 (14).

In certain districts there has been a slight falling-off in the number of entries judged, but in most of these districts the support accorded the competitions recently has been so meagre as to reduce their instructional value. The value of such competitions depends to a considerable degree on the number of entries which are compared during the course of the competition; generally if only a small number of entries are considered the conclusions which may be drawn from a comparison of different methods and results are relatively few and unreliable. This means that such competitions are of distinctly limited value unless they are fairly freely supported, and this may be taken as the reason for the decline that took place last season in certain districts.

One valuable instructive effect of the competitions, even in districts where relatively few entries have had to be considered, lies in the fact that they have provided evidence of the possibility of obtaining highly satisfactory crop-yields by the adoption of suitable management. For instance, although only three crops were judged in the mangel competition in Hawke's Bay, the winning crop, which was grown on land generally typical of large areas in the southern part of the province, and which yielded 55 tons per acre, provides definite evidence that under suitable management profitable mangel crops can be grown under those conditions. Likewise, although only four swede crops were judged in the Wairarapa competition, the fact that the winning crop was one of 60 tons per acre is significant.

The most striking current feature of the competitions has been the growth in popularity of the ensilage competitions, which so far have been confined to Taranaki. The numbers of entries judged during the past four seasons have been as follows: 1926–27, 37; 1927–28, 67; 1928–29, 130; 1929–30, 191.

It is probably indicative of the trend of farm-management in Taranaki to find that as the number of entries in the ensilage competitions increases the number of entries in the special forage-crop competitions tend to decrease. The fact that the entries in the root-crop competitions in Taranaki are falling-off somewhat is not to be taken as showing that Taranaki farmers are becoming less appreciative of the

value of farmers' field competitions; it means merely that modifications in their farm practice have led them to direct their energies along different lines with a similar objective—that is, provision of feed to supplement pastures during critical periods.

Mangels.

Eighty-six crops of mangels, of an average yield of 58 tons 12 cwt. per acre, were judged in the 1929–30 season, as compared with ninety-two crops of an average yield of 59 tons 14 cwt. in the previous season. The slight falling-off in yield may reasonably be attributed to the relatively unfavourable weather conditions in the 1929–30 season. The results of the various districts are summarized in the following table:—

Table 1.—Summary of Mangel Crops.

District.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
North Taranaki ..	34	55	15
South Taranaki ..	24	63	19
Wanganui	18	60	12
Feilding	7	52	14
Southern Hawke's Bay ..	3	49	13

The heaviest crop grown was that of Mr. J. Reid, Toko, which yielded 119 tons 4 cwt. per acre, and won the Sutton Cup for North Taranaki for 1929–30. Of this crop Mr. J. M. Smith, of the Fields Division, New Plymouth, writes: "The whole of the drainage, &c., from Mr. Reid's cow-shed soaked down through the crop, and no doubt was a big factor in the yield. The land was ploughed in July, then worked down with the disks and harrows, and Prizewinner seed sown on 2nd October at the rate of 6 lb. an acre, in 18 in. drills. The manure used was 4 cwt. superphosphate, 3 cwt. blood-and-bone, 3 cwt. kainit, and 3 cwt. nitrate of soda."

In South Taranaki the Sutton Cup was again won by Mr. H. Betts, sen., with a crop of 101 tons 9 cwt. per acre. Mr. Betts sowed on 12th October 5 lb. per acre of Prizewinner seed in drills 18 in. apart, and applied 6 cwt. of manure per acre.

In the Wanganui district the competition winner was Mr. L. Crawley, with a crop of the Prizewinner variety yielding 81 tons per acre. In the Feilding district Mr. A. J. Baxter won with a Prizewinner crop yielding 64 tons 7 cwt. per acre, which was sown on 28th October, the seeding being 6 lb. per acre in 26 in. drills, and 8 cwt. per acre of fertilizer was applied. In Southern Hawke's Bay Mr. W. J. Sedcole won with a crop of Prizewinner which yielded 55 tons per acre, and which received 7 cwt. per acre of high-grade fertilizer.

The mangel competitions disclose the following further interesting facts:—

(1) In all districts the winning crop was the Prizewinner Yellow Globe variety; 75 per cent. of the crops of which records were obtained were Prizewinner.

(2) The average manurial dressing applied to the crops recorded was slightly over 5½ cwt. per acre, exclusive of dressings of salt; the dressing ranged from 13 cwt. to 3 cwt. per acre; two crops received 13 cwt. of fertilizer per acre, and their average yield was 107 tons 9 cwt.

(3) The great majority of the high-yielding crops received a fertilizer dressing of 5 cwt. or more per acre.

(4) In a number of instances crops which received a manurial dressing greater than the average were below the average in yield—evidence that liberal manuring of itself will not ensure good yields.

(5) In slightly less than half the number of crops recorded the fertilizers used were proprietary mixtures. The growers of the winning crops did not use proprietary mixtures.

(6) In the instances in which proprietary mixtures were not used, superphosphate, blood-and-bone, and basic slag were prominent in the dressings used.

(7) The two crops which in the 1929–30 season yielded over 100 tons an acre were sown in drills 18 in. apart; crops ranging in yield from 76 tons to 97 tons per acre were sown in drills 28 in. apart; many excellent crops were grown in drills 20 in. to 26 in. apart.

(8) The amount of seed used ranged from 3½ lb. to 8 lb. per acre, and the use of both these amounts resulted in crops much above the average; 5 lb. to 6 lb. of seed was most generally used.

(9) More mangel crops followed grass than any other crop. It is significant, however, that the highest crop of the season resulted from mangels following mangels, and that a substantial number of other good crops were obtained in this manner.

(10) In the majority of instances the preparatory cultivation was commenced between the middle of August and the middle of October; this was true when the mangels followed grass as well as when it followed another annual crop.

Carrots.

In general, good yields were obtained in the case of the carrot crops, fifty-two crops averaging 42 tons 7 cwt. per acre, as compared with thirty-nine crops averaging 41 tons 7 cwt. in the previous season. The results in the various districts are summarized in the following table:—

Table 2.—Summary of Carrot Crops.

District.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
North Taranaki ..	14	39	19
South Taranaki ..	23	47	12
Wanganui	14	37	11
Feilding	1	22	10

The heaviest crop in the carrot competitions was that of Mr. H. Hoskins, Matapu, South Taranaki, which yielded 66 tons 4 cwt. per acre, and which resulted from sowing 1¼ lb. of Barriball variety

in 14 in. drills on 22nd October, on land which was in mangels the previous season, which was ploughed in October, and which received 3 cwt. per acre of fertilizer.

The winning crop in North Taranaki—that of Mr. N. Berridge, Omata—yielded 62 tons 12 cwt. This was of the Guerande variety, and was sown on 20th November in 14 in. drills on land which was top-dressed with slag before sowing, and which received 3 cwt. of fertilizer at sowing.

In the Wanganui district the first place was taken by Messrs. Murray Bros., Brunswick, with a 61 tons 17 cwt. crop.

The carrot competitions disclose the following further facts :—

(1) The most popular variety is Matchless White, which is characterized by high average yield ; Barriball, Guerande, and White Belgian all have been grown freely and have yielded well.

(2) The average manurial dressing applied to the crops recorded was 4½ cwt. per acre ; the dressing ranged from 3 cwt. to 7 cwt. ; there was one instance in which no fertilizer was applied to land which had grown mangels in the previous season.

(3) Some of the most heavily manured crops were not prominent in respect to yield, and *vice versa*.

(4) With the great majority of the crops recorded special proprietary fertilizer mixtures were used ; when proprietary manures were not used a mixture of superphosphate and bonedust was almost always employed, and was productive of many good yields.

(5) The amount of seed ranged from 1 lb. to 4 lb. per acre ; the seeding usually adopted was from 1 lb. to 1½ lb., and this gave many exceptionally good yields.

(6) Almost invariably the crops were sown in drills 14 in. apart, but really good yields were obtained with crops sown in rows from 16 in. to 28 in. apart.

(7) Carrots frequently followed grass with success, but with equal success they followed other annual crops, including carrots.

(8) Preparatory cultivation was most generally commenced between mid-August and mid-October.

Swedes.

There was a decided falling-off in the number, but an increase in the yield of the swede crops which were judged—sixty-nine crops averaging 44 tons 17 cwt. per acre, as compared with 120 crops averaging 38 tons 14 cwt. for the previous season. The results of the different districts are given in the following table :—

Table 3.—Summary of Swede Crops.

District.	Number of Entries judged.	Yield per Acre.	
		Tons	cwt.
North Taranaki ..	47	46	10
South Taranaki ..	15	41	0
Feilding	3	28	15
Wairarapa	4	51	8

The heaviest crop in the swede competitions and the winner of the Polson Cup was that of Mr. H. Wells, Pukearuhe, North Taranaki, which yielded 71 tons 4 cwt. This crop was of the Superlative variety, and was sown in 14 in. drills at the rate of 12 oz. seed per acre. It was sown just before Christmas on land which produced swedes the previous season, and it received 3 cwt. of fertilizer.

The winning crop in South Taranaki—that of Mr. G. Alexander, Matipu—yielded 52 tons 1 cwt. per acre, and resulted from the sowing on 15th December 12 oz. of Grandmaster seed in 7 in. drills, with an application of 4 cwt. of fertilizer per acre, on land which was previously in grass and which was ploughed on 20th November.

In the Feilding district Mr. W. H. Booth, of Cheltenham, won with a 38 tons 8 cwt. per acre crop of Masterpiece variety, sown on 20th December in 14 in. drills, at the rate of 12 oz. seed per acre, on land which had grown mangels the previous season and which received 4 cwt. of fertilizer per acre.

In the Wairarapa Mr. M. J. Wilton, of Mount Bruce, won the Sutton Cup with a 60 tons 12 cwt. per acre crop of the Superlative variety, which was sown at the rate of 16 oz. seed per acre on 13th December, in 7 in. drills on land which was ploughed out of grass in July and which received 2 cwt. of fertilizer.

The swede competitions disclose the following further facts:—

(1) In South Taranaki nearly all the recorded crops were of the Grandmaster variety, but Superlative, Masterpiece, and Magnum Bonum were also grown; in other districts Superlative, Masterpiece, and Grandmaster shared popular favour almost equally, while Vilmorins and Magnum Bonum also received fair attention.

(2) The amount of manure used ranged from 2 cwt. to 7 cwt. per acre, and averaged 3½ cwt. The manures used were extremely variable in composition, and the only common feature is that phosphates were the dominant constituent. Apart from proprietary mixtures, a dressing consisting of about two parts of superphosphate to one of bone manure was most generally used, and gave good results.

(3) Almost invariably swedes were sown in land ploughed out of grass—quite a sound practice, in view of the incidence of such diseases as club-root and dry-rot. In a few instances swedes followed swedes, and generally the resulting crops were relatively low in yield.

(4) The amount of seed used ranged from 9 oz. to 24 oz., both of which quantities gave really good crops. The practice most generally adopted was the sowing of 12 oz. to 16 oz. of seed in rows 14 in. apart, and a high proportion of the outstanding yields resulted from this method.

Chou Moellier.

In North Taranaki two crops of chou moellier were judged. The winning crop — that of Mr. J. L. Corlett, Ratapiko — weighed 33 tons 11 cwt. Last season Mr. Corlett was also the winner, with a crop weighing 48 tons 13 cwt. In South Taranaki four crops were judged, and the winning one—that of Mr. A. A. Piper, Lowgarth—weighed 25 tons.

Soft Turnips.

The only competition for soft turnips was conducted in South Taranaki, where eight crops were judged, the winning one—that of Mr. A. T. Burke, Lowgarth—weighing 45 tons 16 cwt.

Lucerne.

In South Taranaki Mr. W. J. Hollis won the "old stand" competition, in which there were nine entries.

Potatoes.

The only potato competition, which was in Southern Hawke's Bay, attracted three entries, and was won by Mr. G. R. Kells, Norsewood, with a 21 tons 4 cwt. crop of Sutton's Supreme, which received 10 cwt. per acre of a fertilizer containing superphosphate, sulphate of ammonia, and sulphate of potash.

Ensilage.

In North Taranaki there were four classes for ensilage in the season under review. These were (1) stacks, (2) hillside stacks, (3) earth pits, (4) concreted pits. A hillside stack is a stack let into the ground on a hillside, having one or more sides against a bank but not being completely enclosed.

Stacks.—Mr. A. Turnbull, Huirangi, with a total of 94½ points out of 100, won the Fertilizer Company's Cup for stack ensilage, out of 105 entries. Mr. J. M. Smith, of the Fields Division, writes: "The outstanding feature of the winning stack was the way in which waste had been reduced to a minimum. One of the great drawbacks to the stack method of making ensilage is the waste that occurs, and every endeavour should be made during saving and building to have this as small as possible. In Mr. Turnbull's stack the waste was only about 4 in. on all sides. The quality of the raw material and the way it had been conserved were also strong features, and the points gained under these headings were 58 out of 60. The pasture the winning stack was made from was ten years old, and had been sown down with a good mixture which included a good perennial rye. The pasture had been well looked after, and the top-dressing during the past season was with 1½ cwt. basic super, 1½ cwt. rock phosphate, and 1 cwt. 30 per cent. potash. The crop was cut on 12th December, while the herbage was in a young growing condition. The size of the stack was 21 ft. square. The material came in straight from the mower, and the stack was built to a height of 8 ft. the first day. Building was continued and completed the following day, when the stack went to the height of 15 ft., and 15 in. of soil was put on straight away. Planks on edge were used to hold the soil, and a very good job was made of the topping. The material went in very wet, and it was actually raining part of the time during cutting."

That the competitions are proving instructive is indicated by a report from Mr. J. M. Smith, as under:—

"The following points were noticeably brought out during the past season in connection with stack ensilage:—

"(1) The crops should be cut at an earlier stage than has been the case in the past. The season saw an improvement in this respect, but

there is still room for further improvement generally speaking. Almost without exception the stacks gaining high points for quality were those cut early.

"(2) The quality of the raw material is a big factor in the quality of the resultant ensilage, and many competitors who conserved their material in splendid condition lost points on account of the poor quality of the grasses.

"(3) That rain does not greatly interfere with the quality of the ensilage made was evident from the fact that many of the stacks gaining high points were actually saved in the rain.

"(4) The sooner the material can be put into the stack after it is cut the better.

"(5) Care in building—keeping the walls upright and the centre slightly high—is reflected in the resultant amount of waste. The centre of the finished stack should not be too high, however, otherwise trouble will be experienced in getting the soil to hold in the top. Likewise the walls should have plenty of height in them and should not be rounded off. A flat ledge round the edge of the stack for holding the soil is a good idea.

"(6) There is no necessity to miss a day between buildings. Where hand-pitching is being done, however, the missing of a day may be an advantage in order to get the benefit of the subsidence.

"(7) In the past there appears to have been a tendency to allow the temperature to get too high. Slightly over 100° F. appears to be high enough, although there is a big range of temperature under which good ensilage can be made. One stack in which the temperature reached 140° turned out just as good as that where the temperature was 105°.

"(8) At least 1 ft. of soil should be put on, and this should be brought well out on to the sides. Where rakings are put on top just under the soil it is inevitable that a dark ensilage will result.

"(9) One of the best methods of holding the soil well out is to use wire netting, but other methods are just as successful if carefully done.

"(10) Open the stack in such a fashion that about 6 in. to 8 in. is removed daily. If the herd is large and the stack small the whole top may be uncovered and the stack fed from all over, but otherwise it will pay to take a section right down to the ground."

Hillside Stacks.—The class of twenty entries for hillside stacks was won by Mr. W. W. Thorby, Kaimata, who also won Blyde Bros.' Cup with a total of 94 points. The material of this stack was cut on 18th December from four-year-old pasture. Building was carried on continuously from the cutting of the material. Twelve inches of soil was put on the stack as soon as it was completed, and was held in position by sacks.

Earth Pits.—There were sixteen entries in the class for earth pits, and the winner was Mr. A. J. Hall, Hillsborough, with 94 points. The cutting of the material, which was from ten-year-old pasture, was commenced on 6th December, and material to a depth of 14 ft. was put in the pit the first day. Three days were missed, and then another 8 ft. added, and three days later a further 8 ft. was put in. The pit was 15 ft. in diameter and 14 ft. in depth, with perpendicular walls, and it was fitted with a wood and iron roof.

Concrete Pits.—In the class for concrete pits six entries were judged, and the winner was Mr. P. A. Openshaw, Lepperton, with 96 points. The material was cut in November from twenty-year-old pasture in which rye-grass was dominant. The pit was filled to a depth of 10 ft. the first day, and subsequent additions of material were made at intervals of a day and a half, while two days elapsed between the final addition of green material and the putting-on of the soil covering. The pit was 18 ft. in diameter and 20 ft. deep.

This competition brought out the following points:—

(1) In the pit method waste of material by decay is practically eliminated and labour costs are reduced.

(2) The temperature of the material rises more slowly in pits than in stacks; hence with pits longer intervals between successive additions of green material are necessary.

(3) Whether the walls are slightly sloping or perpendicular is of little importance, but more waste occurred on the average with sloping walls.

(4) In feeding from pits, in order to avoid unnecessary waste, material should be removed from the whole top surface at the one time.

In South Taranaki two ensilage competitions were conducted. In the stack class of thirty entries the winner was Mr. N. W. Scown, Otakeho, and in the pit class of fourteen entries Mr. T. Harworth, of Auroa, came first.

Hay Competition.

In North Taranaki the winners of a class of fifty-four entries was Messrs. J. F. Phillips and Sons, Urenui, who obtained 94 points, and who take the Daily News Cup. In South Taranaki a class of fifteen entries was won by Mr. H. Ward, Tokaroa, with 89 points.

RUAKURA FARM TRAINING COLLEGE.

The growing popularity of the practical course in farming available for lads at the Ruakura Farm Training College is evidenced by the fact that the Department has not been able to accept a number of applications received for the first term of 1931, owing to all available vacancies having been filled. Already several applications for entrance to the College in June, 1931, have been accepted, and parents wishing their sons to commence at Ruakura for the second term are advised to submit applications at the earliest possible date.—*Fields Division.*

Dealing with Second-growth Country.—The annual report of the Fields Division for 1929–30 makes the following reference to this subject: "Experimental work on hill country (particularly in Whangamomona County) reverting to secondary growth has been continued, and the excellent results secured are being made use of over a wide area of country wherein the conditions are similar to those existing there. The demonstration farm conducted in Whangamomona County under the provisions of the Deteriorated Lands Act has been carried on throughout the year, and notwithstanding that it is being run partly on experimental lines the good work done by those responsible on the place has resulted in quite excellent returns being shown. The instructional officers of this Division continue to co-operate with the officers of the Lands Department in the work necessitated in connection with advances under the Deteriorated Lands Act, particularly in the back country of Taranaki and the King-country, and great improvement is shown. This is brought about chiefly by the use of fertilizers and by subdivision. There are still 871 farms under supervision."

WINTON EXPERIMENTAL FARM.

RECORD OF WORK FOR SEASON 1929–30.

R. B. TENNENT, Fields Superintendent, Department of Agriculture, Dunedin.

DURING the season of 1929–30 the Winton Experimental and Demonstration Farm was mainly devoted to a furtherance of the pasture-work previously laid down with the object of ascertaining the value of various species of grasses and clovers, and the effect of intensive manuring under a rotational-grazing system of management. The general trend towards adoption of the more intensive type of grassland farming has of recent years called for quite extensive researches into its many phases, and the Management Committee is to be commended for its initiative in utilizing the farm for this purpose, thus assisting Southland farmers to determine the efficacy or otherwise of the system. Other grassland problems investigated during the season included the establishment of pastures, their maintenance, and utilization methods aimed at a more economical conversion of the pasture into various animal products.

In continuance of the policy laid down by the Committee of gradually establishing a dairy-herd on the farm, the small herd of ten cows was increased to twenty-six by the end of the milking season. Several pedigree milking Red Poll cattle were also purchased from the Weraroa Experimental Farm, together with a pedigree Friesian bull to head the grade herd. A three-cow milking plant electrically driven was also installed. The herd was entered for testing under the Southland Herd-testing Association. Further, a line of high-grade Friesian heifer calves were purchased and reared on the farm. The planting of shelter-belts, so necessary on a farm of this kind, was carried out.

ROTATIONAL GRAZING INVESTIGATION.

In September, 1928, an area of 20 acres, comprising Blocks 2, 4, 6, and 8, was subdivided in such a way as to give eight fields, each of $2\frac{1}{2}$ acres in extent, an adequate water-supply being provided for each field. These fields during previous years had been treated with various phosphatic and potassic manures, together with carbonate of lime and burnt lime. The plant association also differed widely, including fields of both high and low quality of pasture. (See plan on page 410.)

With the introduction of the intensive rotational-grazing trial it was decided to simplify the manurial programme by treating the whole area with 44–46 per cent. superphosphate, applied during the month of September, 1928, at the rate of 2 cwt. per acre. By November of that year it was quite evident that the small herd of ten cows was totally inadequate to effectively control the grazing on this 20 acres. Four fields, each of $2\frac{1}{2}$ acres in extent, were therefore closed to stock and cut for hay during early January, 1929. The remaining four fields were grazed as bare as was practicable, then mown, and closed up to recover.

During this period the weather was entirely favourable for pasture-growth, and the fields recovered sufficiently to give a further grazing in from seventeen to twenty-four days. Four of the fields were then temporarily fenced into $1\frac{1}{4}$-acre blocks in order to suit the permanent

watering system, with the object of more efficiently controlling the pasture-growth. Up to the end of March this 10 acres was found to carry the ten cows above mentioned. The autumn experience thus gained proved of great practical value in deciding the stocking-capacity for the spring of 1929.

The manurial programme adopted for the various fields is summarized as follows:—

(1) All fields comprised in the 20 acres received a dressing of 44–46 per cent. superphosphate during April, 1929, and again in January, 1930, at the rate of 2 cwt. per acre.

(2) In addition 1 cwt. per acre of sulphate of ammonia was given to the following fields on the dates specified:—

Field.	First Dressing.	Second Dressing.	Third Dressing.
2A	4/7/29	11/10/29	28/3/30
4B	18/7/29	15/10/30	29/3/30
6A	3/8/29	21/10/29	25/3/30
8B	15/8/29	22/10/29	24/3/30

The system of grazing followed closely along lines laid down as ideal for the control of pastures by the milking-herd or first-line production stock. Grazing returns from each field were accurately recorded, this allowing for an investigation into the merits or otherwise of highly soluble nitrogenous fertilizer when used to promote "out of season" grass. Each field was adequately harrowed when occasion showed the necessity for so doing.

As could be expected, the response from sulphate of ammonia varied considerably, and was apparently very largely dependent on the age and composition of the pasture to which it was applied. Generally speaking, from seven to ten weeks' time was required to produce a good dense growth of grass, 5 in. to 6 in. in height, from the July application. On young pastures in Southland this result is usually obtained in about five to seven weeks, while for old pastures in poor condition anything up to twelve weeks' growth is required. Several of the earlier-treated fields were ready for grazing before the majority of the herd came into profit; hence the grazing of those fields was somewhat curtailed, necessitating lengthy periods of grazing to cope with the extra growth. It is to be recorded that the value of sulphate of ammonia was evinced by its producing herbage from two to three weeks earlier than on those fields not top-dressed with this fertilizer. The grass-stimulation was particularly noticeable with perennial rye-grass and meadow foxtail, and cocksfoot was also much improved. With regard to white-clover growth, an improvement was apparent during the earlier part of the season, but by late December this superiority had largely disappeared; in fact, the fields treated with sulphate of ammonia showed quite an apparent diminution of white clover.

After the first grazing by the dairy herd and the followers, which comprised a line of 200 good-conditioned wethers, each field was again harrowed and received a further dressing of sulphate of ammonia at the rate of 1 cwt. per acre, being then closed to stock. The spring growth proved particularly good on all but one field, with the result that the

whole herd of twenty-six cows was carried on the 20 acres until the end of December, 1929, with one exception. This occurred through several of the fields being grazed too hard and bare by the wethers, so that recovery of those fields was prolonged, thus necessitating the use of one other field of 2 acres as a night paddock for thirteen nights, from 23rd November to 5th December.

RESULTS OF TRIAL.

The following tabulation gives the comparative figures for grazing-days and butterfat-production for the various fields under trial.

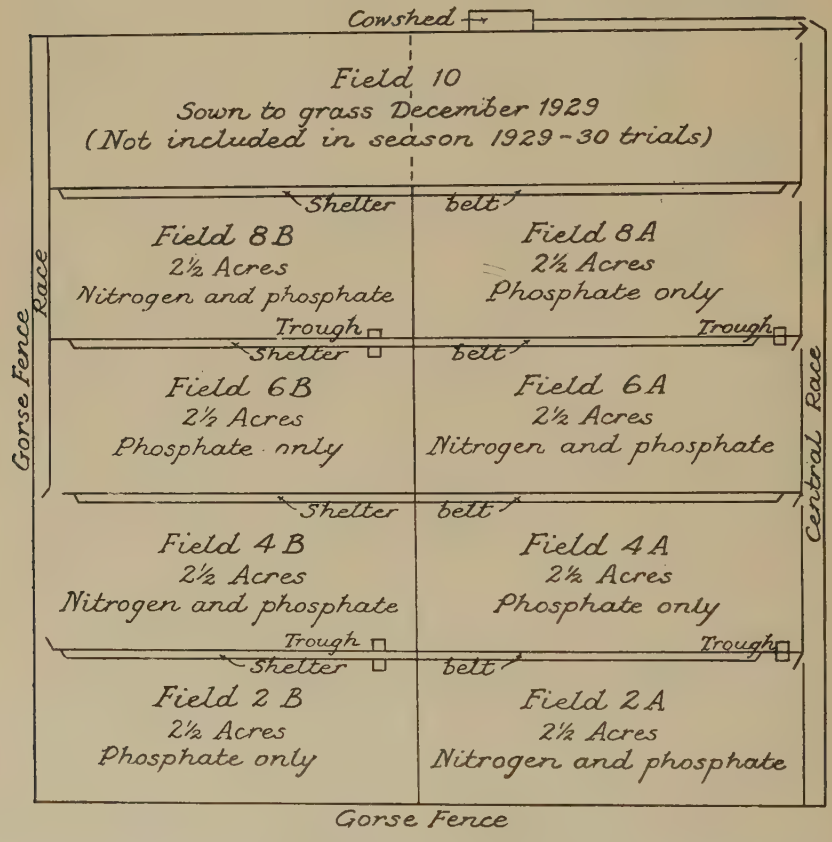
Table 1.—Results of Rotational Grazing Trial, 1st July, 1929, to 30th June, 1930.

Field No.	Treatment.	Cow Days per Acre.	Butterfat per Acre.	Dry-stock Days per Acre.
2A ..	Nitrogen and phosphate ..	243·3	243·3	67·4
2B ..	Phosphate only ..	206·4	212·7	54·4
Difference in favour of nitrogen ..		36·9	30·6	13·0
4B ..	Nitrogen and phosphate ..	287·1	276·0	93·7
4A ..	Phosphate only ..	277·2	271·7	63·0
Difference in favour of nitrogen ..		9·9	4·3	30·7
6A ..	Nitrogen and phosphate ..	226·9	221·6	49·2
6B ..	Phosphate only ..	125·5	121·5	77·3
Difference in favour of nitrogen ..		101·4	100·1	—28·1
8B ..	Nitrogen and phosphate ..	195·3	211·2	87·9
8A ..	Phosphate only ..	238·8	239·7	35·9
Difference in favour of nitrogen ..		—43·5	—28·5	..
Average differences in favour of nitrogen		26·2	26·6	16·9

NOTE.— "Cow days per acre" = number of cows grazed × number of days ÷ acres. "Dry-stock days" are similarly calculated. Stock other than dry cows are calculated as a fraction of a dry cow, according to type and age.

While the general results from the whole 20 acres under trial were more or less what one expected as a result of using sulphate of ammonia, an examination of individual pairs of fields show in some cases disappointing results. Broadly speaking, what might be termed the best pastures have given the poorest response to sulphate of ammonia, and, conversely, the poorest fields have given the most payable returns. This is clearly shown by a comparison of Fields 4 and 6. Field 4 is the best pasture on the farm, and gave the highest butterfat per-acre return, 276 lb. being produced from that half receiving nitrogen and phosphate, and 271·7 lb. from that half dressed with phosphate alone. The increase due to nitrogen, however, is only 4·3 lb. per acre. When this result is contrasted with that obtained from Field 6, which undoubtedly is a poor pasture, requiring renewal, it can at once be noted that here sulphate of ammonia has given a very definite increase in butterfat-production. That Field 6 is a poor producer will be noted

from the fact that the half dressed with phosphate yielded only 121·5 lb. of butterfat per acre, as against a yield of 271·7 lb. from the similarly treated half of Field 4. With the application of nitrogen, however, a high percentage increase occurred on Field 6, the half treated with nitrogen and phosphate returning 221·6 lb. of butterfat, an increase of 100·1 lb. over the half field treated with phosphate alone.



PLAN OF ROTATIONAL GRAZING TRIAL AT WINTON EXPERIMENTAL FARM, SEASON 1929–30.

This result is contrary to what one would expect, as it has always been assumed that payable responses from sulphate of ammonia could only be looked for by applying this fertilizer to high-producing pastures. It must, however, be admitted that the superiority of nitrogen response on the poor Field 6 over the response on the good Field 4 seems to be quite anomalous. Consideration of the dry-stock days would indicate that better utilization with milking-cows on the phosphate-alone half of Field 4 has been carried out than on the nitrogen half on which the growth had to be cleaned up with dry stock. With Field 6, however,

the reverse is the case. The results in total stock days (cow days plus dry-stock days) for each field are therefore as follows :—

	Field 4. Stock Days.	Field 6. Stock Days.
Phosphate and nitrogen	380·8	276·1
Phosphate only	340·2	202·8
Difference in favour of nitrogen	40·6	73·3

The nitrogen effect is still shown to be greater on the poorer pasture of Field 6. This field was practically devoid of clover, and, as the writer's experience in the South has repeatedly shown that phosphate responses are largely represented by increases in clover-growth, it will be realized that the absence of clover in Field 6 gave the nitrogen field a decided advantage over the phosphate field. In the case of the nitrogen half of Field 8 also it is evident that full advantage has not been taken of the grass by the use of milking-cows, and that the pasture has required more dry stock as followers to clean it up than is the case with the phosphate half. The total stock days (cow days plus dry-stock days) are as follows : Phosphate plus nitrogen, 283·2 ; phosphate only, 274·7 : difference in favour of nitrogen, 8·5.

It must be borne in mind, however, that the grazing was conducted in an exceptionally good manner throughout the trials, being in all probability much more effectively done by the farm staff than would be the case with the average farmer. If the success of rotational grazing and intensive manuring with phosphates and nitrogen is dependent on extremely refined methods of grazing, then its practical application on farms will undoubtedly meet with many failures.

Ignoring individual records from various pairs of fields, and taking the average production over the whole 20 acres under trial, it will be observed that those fields treated with sulphate of ammonia and phosphate gave an increase over the fields treated with phosphate alone of 26·2 cow days per acre, and a butterfat increase of 26·6 lb. per acre. In addition to this an increase of 16·9 dry-stock days per acre has to be credited to the use of sulphate of ammonia.

It is interesting at this stage to attempt a comparatively simple costing examination of the two sets of fields, with a view to ascertaining whether the application of sulphate of ammonia was profitable in use. For the purpose of this examination butterfat has been valued at 1s. 4d. per pound (the approximate value for the 1929–30 season), dry-stock grazing at 3d. per day, and sulphate of ammonia at 12s. 6d. per hundredweight. No consideration has been taken of the cost of railage and cartage of the fertilizers to the farm, nor the expenditure involved in time and labour in applying them to the various fields. On this basis the results are as shown in Table 2 (next page).

From this table it will be observed that in the case of Field 2 a small profit of 6s. 7d. per acre was obtained from the use of nitrogen, and from Fields 4 and 6 a profit of £3 6s. 6d. and £3 19s. per acre respectively. In the case of Field 8, however, the application of nitrogen showed a loss of £3 2s. 5d. per acre. Taking the average of all fields under trial, the total revenue from those fields treated with nitrogen and phosphate was £16 13s. 6d. per acre, as against £13 13s. 7d.

Table 2.—Comparison of Costs between Fields treated with Nitrogen and Phosphate against Phosphate alone, at Per-acre Values.

Field No.	Value of Butterfat.		Value of Dry-stock grazed.		Total Value.		Difference per Acre.	Cost of Nitrogen per Acre.	Profit or Loss per Acre.
	Phosphate plus Nitrogen.	Phosphate.	Phosphate plus Nitrogen.	Phosphate.	Phosphate plus Nitrogen.	Phosphate.			
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
2	16 4 5	14 3 7	0 16 10	0 13 7	17 1 3	14 17 2	2 4 1	1 17 6	0 6 7 P.
4	18 8 0	13 11 8	1 3 5	0 15 9	19 11 5	14 7 5	5 4 0	1 17 6	3 6 6 P.
6	14 5 6	8 2 0	0 12 4	0 19 4	14 17 10	9 1 4	5 16 6	1 17 6	3 19 0 P.
8	14 1 7	15 19 6	1 2 0	0 9 0	15 3 7	16 8 6	1 4 11	1 17 6	3 2 5 L.
Average per acre	15 14 10	12 19 2¾	0 18 8	0 14 5	16 13 6	13 13 7	2 19 11	1 17 6	1 2 5

per acre from those fields treated with phosphate alone, a difference of £2 19s. 11d. per acre in favour of the nitrogen-treated fields. Deducting the average per-acre cost of nitrogen, it then appears that the application of sulphate of ammonia to the Winton Experimental Farm pastures resulted in a profit of £1 2s. 5d. per acre, out of which the railage of manures and cost of application has to be met.

As a result of an analysis in regard to the grazing obtained during the various periods it is to be recorded that on every field there are more dry-stock days on the nitrogen-treated halves for the first two periods than on the phosphate halves, with one exception. This would point very clearly to inefficient utilization of grass by milking-cows. If this is so, then this inefficiency was in all probability caused by allowing the grass to grow too long before the cows were put on, with the result that they could not be made to clean it up without decreasing in milk-yield.

Assuming that good use of the field had been made by milking-cows and that exactly the same number of dry-stock days had been required to clean up the nitrogen fields as was the case with the phosphate ones, there would have been an average of about eighteen more cow days per acre on the nitrogen fields. Since a cow day produces about 1 lb. of butterfat at 1s. 4d., the extra cow days would have given eighteen times 1s. 1d. (1s. 4d., less 3d., for each dry-stock day) greater financial return.

It has to be admitted that several anomalies in the results have occurred which are difficult to explain, but a general summary of the season's work at Winton in rotational grazing and intensive manuring does not show the high returns which might have been expected from the use of soluble nitrogen.

It is impossible to say what the effect has been on subsequent production of the herd of having grass earlier than would have been the case had nitrogen not been used. The saving of supplementary fodder, however, must have amounted to several shillings per acre.

Potato Manurial Trials.

A series of potato manurial trials designated A, B, C1, and C2 were laid down with a view to determining the effects of various fertilizers. The outline and results of these experiments are briefly summarized as follows:—

Experiment A.—The object of this experiment was to determine to what advantage superphosphate in excess of 3 cwt. per acre would be beneficial to the potato crop. Ten replications of the following treatments were made: Super 44-46 per cent., 3 cwt., 5 cwt., and 7 cwt. per acre. Table 3 summarizes the results.

Table 3.—Summary of Yields in Experiment A.

All yields are averages from ten weighings.

Treatment per Acre.	Yield and Increase per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
No manure	1·0	0·6	0·4	2·0
Super 3 cwt.	2·1	1 0	0·7	3·8
Increase over no manure ..	1·1 (S)	0·4 (S)	0·3 (S)	1·8 (S)
Super 5 cwt.	2·2	1·1	0·9	4·2
Increase over super 3 cwt. ..	0·1 (NS)	0·1 (NS)	0·2 (NS)	0·4 (NS)
Super 7 cwt.	2·5	1·1	0·8	4·4
Increase over super 3 cwt. ..	0·4 (S)	0·1 (NS)	0·1 (NS)	0·6 (S)
Increase over super 5 cwt. ..	0·3 (NS)	0·0 (NS)	—0·1 (NS)	0·2 (NS)

NOTE.—(S) denotes that increases are statistically significant, (NS) not significant. This applies to all tables where occurring.

It will be seen that a steady increase in yield with increasing quantities of super was recorded, but the differences between super 3 cwt. and super 5 cwt., and between super 5 cwt. and super 7 cwt., were not significant.

Experiment B.—The object of this trial was to determine the effect of using nitrogen and potash as adjuncts to superphosphate in the manuring of potatoes. Ten replications of each treatment were carried out, with the following results, as shown in Tables 4 and 5.

Table 4.—Summary of Yields in Experiment B.

Treatment per Acre.	Yield per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt.	2·3	0·7	0·5	3·5
Super 3 cwt. plus sulphate of ammonia 1 cwt.	3·5	0·8	0·5	4·8
Super 3 cwt. plus sulphate of ammonia 1 cwt. plus potash 1 cwt.	3·0	0·6	0·6	4.2
Super 3 cwt. plus potash 1 cwt. ..	2·2	0·5	0·5	3·2
Super 3 cwt. plus sulphate of ammonia 2 cwt.	2·8	0·5	0·5	3·8

Table 5.—Summary of Differences between Treatments in Experiment B.

Treatment per Acre.	Differences per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt. plus sulphate of ammonia 1 cwt.—				
Increase over super 3 cwt. ..	1·2 (S)	0·1 (NS)	0·0	1·3 (S)
Increase over super 3 cwt. plus sulphate of ammonia 1 cwt. plus potash 1 cwt.	0·5 (NS)	0·2 (NS)	—0·1 (NS)	0·6 (NS)
Increase over super 3 cwt. plus sulphate of ammonia 2 cwt.	0·7 (S)	0·3 (NS)	0·0	1·0 (S)
Super 3 cwt. plus sulphate of ammonia 1 cwt. plus potash 1 cwt.—				
Increase over super 3 cwt. ..	0·7 (S)	—0·1 (NS)	0·1 (NS)	0·7 (S)
Increase over super 3 cwt. plus potash 1 cwt.	0·8 (S)	0·1 (NS)	0·1 (NS)	1·0 (NS)
Super 3 cwt. plus potash 1 cwt.—				
Decrease from super 3 cwt. ..	0·1 (NS)	—0·2 (NS)	0·0 (NS)	—0·3 (NS)
Super 3 cwt. plus sulphate of ammonia 2 cwt.—				
Increase over super 3 cwt. ..	0·5 (S)	—0·2 (NS)	0·0 (NS)	0·3 (NS)

An analysis of Tables 4 and 5 shows that the application of 3 cwt. of super plus 1 cwt. of sulphate of ammonia gave the best yield. Potash appears to have had no effect in increasing yields, and the application of 2 cwt. of sulphate of ammonia does not appear warranted.

Experiment C.—This experiment was designed to determine the relative merits of superphosphate plus sulphate of ammonia, and the newer ammonium phosphates. The experiment was divided into two —C1 and C2.

Table 6.—Summary of Yields in Experiment C1.

Each yield is the average of ten weighings.

Treatment per Acre.	Yields and Increases per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt. plus potash 1 cwt. ..	1·8	1·1	0·9	3·8
Super 3 cwt. plus Ammophos plus potash 1 cwt.	3·0	1·3	1·2	5·5
Increase over super 3 cwt. plus potash 1 cwt.	1·2 (S)	0·2 (NS)	0·3 (S)	1·7 (S)
Ammophos plus potash 1 cwt. ..	2·6	1·1	1·0	4·7
Increase over super 3 cwt. plus potash 1 cwt.	0·8 (S)	0·0	0·1 (NS)	0·9 (S)
Diammonphos plus potash 1 cwt.	3·1	1·4	1·2	5·7
Increase over Ammophos plus potash 1 cwt.	0·5 (NS)	0·3 (NS)	0·2 (S)	1·0 (NS)

Table 7.—Summary of Yields in Experiment C2.

Each yield is the average of eight weighings.

Treatment per Acre.	Yields and Increases per Acre.			
	Table.	Seed.	Small.	Total.
	Tons.	Tons.	Tons.	Tons.
Super 3 cwt. plus potash 1 cwt. ..	1·9	1·8	1·8	5·5
Super 3 cwt. plus sulphate of ammonia plus potash 1 cwt.	3·0	1·9	2·1	7·0
Increase over super 3 cwt. plus potash 1 cwt.	1·1 (S)	0·1 (NS)	0·3 (S)	1·5 (S)
Increase over Ammophos plus potash 1 cwt.	0·3 (S)	0·3 (S)	0·1 (S)	0·7 (S)
Ammophos plus potash 1 cwt. ..	2·7	1·6	2·0	6·3
Diammonphos plus potash 1 cwt.	2·6	1·7	2·0	6·3
Increase over Ammophos plus potash	—0·1	0·1	0·0	0·0

With regard to the last two tables, it is to be noted that the difference between Ammophos plus potash and Diammonphos plus potash are not significant when the two experiments are taken together.

Time of Application of Fertilizers in Pasture Top-dressing.

An experiment was laid down in June, 1929, with the dual object of ascertaining (1) the effect on production of applying superphosphate in winter, spring, summer, and autumn, and winter plus summer, and (2) to determine the effect of applying nitrogen in the form of sulphate of ammonia in June and March. The lay-out of the plots, totalling 168, was designed by the Crop Experimentalist, and his findings on this experiment will be published in due course when dealing with others of a similar nature laid down elsewhere.

Mangel Variety Trial.

A mangel variety trial was conducted, six varieties being sown, with a dressing of 3 cwt. of agricultural salt broadcast and worked in with 4 cwt. superphosphate, 1 cwt. sulphate of ammonia, and 1 cwt. potash salts. Owing to a poor strike and the necessity for transplanting, weights were not taken, but observations made throughout the growing-period resulted in the varieties being placed in the following order of merit: (1) Long Red, (2) Prize-winner, (3) Jersey Queen, (4) White Knight, (5) Golden Tankard, (6) New Combination.

Trial on Origin of Seed Potatoes.

This trial was laid down as one of a series being conducted in various parts of the Dominion by the Agronomist, with the object of ascertaining what districts are most suited for the production of seed potatoes. Approximately ¼ acre was planted with Arran Chief seed obtained from Ashburton. The crop made fair growth, but the yield was very disappointing, amounting in all to 7·2 tons per acre. Of this yield 1·7 tons were graded table size, 3·6 tons seed, and 2·1 tons small. The yield, however, was in keeping with those obtained from other plots in

different districts which had been planted with seed of the same line. Two hundred pounds of seed was sent to Ashburton Experimental Farm to be grown there, and a sufficient quantity was retained to carry on the investigation for another year at Winton.

Grass and Clover Strains.

Rye-grass: A comprehensive series of plots were hand sown in Field 7 during late October and early November, 1929. Some 200 plots, including rye-grass from different colonial sources and of imported origin were sown in accordance with the scheme formulated by the Agrostologist. These plots, although competing with a heavy growth of yarr (spurrey), made excellent progress, and the differences are now quite striking, showing up the early maturity of the Canterbury lines, the intermediate position occupied by Southland lines, and the relatively slow establishment of many of the best perennial types from Hawke's Bay, Poverty Bay, and Sandon. This trial occupies an area of 4 acres.

Cocksfoot and Red and White Clover: A series of 200 plots corresponding to the rye-grass trials were sown in Field 5. A good perennial line of Hawke's Bay rye-grass was used throughout as a base sowing. By January, 1930, the Danish types of cocksfoot could be easily differentiated on account of their taller and more open habit of growth.

Oats Manurial Experiment.

An experiment was laid down on 5th November, 1928, with Garton oats. A seeding of 3 bushels per acre was used, and the manurial treatments were as follows:—

(1) Superphosphate 2 cwt.
(2) Super 2 cwt. and sulphate of potash 1 cwt.
(3) Super 2 cwt. and sulphate of ammonia 1 cwt.
(4) Super 2 cwt., sulphate of ammonia 1 cwt., and sulphate of potash 1 cwt.

Note.—The sulphate of ammonia was applied by hand on the 19th December, 1928.

The crop was harvested on 15th March, 1929, with results as follows:—

Table 8.—Results of Oats Manurial Experiment.

Each yield is the average of twenty weighings each 1 chain 53 ft. by 4 ft. 1 in.

Treatment per Acre.	Yields per Acre.	Increase over Super 2 cwt.	Chaff equivalent as Percentage of Weight when cut.
	Tons.	Tons.	
(1) Super 2 cwt.	3·5	..	61·0
(2) Super 2 cwt. and sulphate of potash 1 cwt.	3·8	0·3 (S)	61·0
(3) Super 2 cwt. and sulphate of ammonia 1 cwt.	4·2	0·7 (S)	61·4
(4) Super 2 cwt., sulphate of ammonia 1 cwt., and sulphate of potash 1 cwt.	4·2	0·7 (S over super and super plus potash)	63·5

All nitrogen plots showed taller growth and later maturity. No difference due to potash could be noticed. The oats experiments are being pushed forward a step further in the current season.

Top-dressing of Pastures.

Blocks 1, 3, and 9 have been top-dressed, as in previous years, with various phosphatic manures, including super, basic slag, Seychelles phosphate, and Nauru. Carbonate of lime and crushed burnt limestone applied in previous years as cross-dressings in these fields still continue to show quite marked improvement in colour, also in clover and bottom growth. Both sheep and cattle show a preference for the limed areas, even though the limestone was applied as far back as 1925 in some instances.

Ensilage.

In March, 1929, some 4 acres of oats and tares was ensiled in a small pit about 6 ft. deep. This crop was a little over-ripe, and owing to insufficient labour at time of ensiling the operation was unduly prolonged. This allowed the temperature to run high, and a brown silage resulted. The loss of silage at the pit-mouth was not warranted, and disclosed the weakness of not tramping the material hard at this point.

During the winter some 20 tons of the silage was fed out to dry cows, and feeding was continued after the herd came to profit; no difficulty was experienced in getting the cows to take to it. As soon as the herd was placed on the lush grass in the rotational-grazing trial fields the feeding of silage was discontinued.

Raising of Fat Lambs.

In March, 1928, a small flock of Romney Marsh cross 2-tooth ewes was divided into five groups, and each group mated with a different breed of ram, comprising Shropshire, Ryeland, Border Leicester, English Leicester, and Southdown. Lambing commenced in October, and all the lambs were sold by March. The results were as follows:—

Table 9.—Results of Lamb Trials.

Ram.	Lambing Percentage.	Percentage of Fat Lambs.	Average Dressed Weight.
			lb.
Border Leicester ..	100	60	35·92
English Leicester ..	75	60	34·89
Southdown	85	53	34·78
Ryeland	73	64	32·67
Shropshire	68	100	31·69

The experiment could not be considered very conclusive. A heavy growth of grass, combined with a wet season, caused foot trouble among the ewes, and this seriously affected their condition. After the foot trouble had been cleaned up the lambs were placed on to small breaks of rape and oats, and were then fattened off on a swede crop which had proved a failure owing to club-root infection.

Kentish Wild White Clover.

A portion of Fields 8A and 8B (which were originally laid down in pasture in 1926) was given Kentish wild white clover in the mixture at the rate of 2 lb. per acre, in place of the New Zealand white clover sown on the remainder of the area. Since 1928 the Kentish wild white portion has been markedly superior to the remainder of the area. An observer would come to the conclusion that the former portion had either been sown out in different grasses or had received special manurial treatment. The grass-growth throughout this part is definitely superior, the colour is a darker green, and the stock show a particular liking for it. The Kentish wild white clover is much later in flowering in the autumn, but its most striking feature is its dense spreading cover growth.

General.

A field-day in March, 1929, was attended by some sixty farmers. In October of the same year the visiting Tasmanian farmers, in company with local farmers, also paid a brief visit and inspected the various pasture blocks. A new departure was made by holding a field-day in December, so that farmers might view the various pasture blocks at a particularly interesting stage.

During the period under review the Winton Experimental and Demonstration Farm Committee acted under the able chairmanship of Mr. D. H. McLean, of Caroline. Mr. G. L. Smart took over his duties as manager of the farm in August, 1928, and the amount of work that has been accomplished during the period is largely owing to his enterprise and industry. The experimental side and general supervision were in the hands of Mr. G. W. Wild, late Instructor in Agriculture, Invercargill.

DUSTING *VERSUS* SPRAYING FOR FUNGUS CONTROL.

In America especially there has been a tendency to replace sprays with dusts, owing to the ease of application of the latter, and numerous requests have been received from New Zealand growers as to which is the more efficacious method.

Experiments conducted in America and England over a period of years have shown that in a normal season there is little difference in yields of sprayed or dusted plots; but in an epiphytotic season—that is, a season in which blight is very severe—spraying is much more effective. The reason for this is that dusts do not adhere well to the foliage, over 50 per cent. being lost within one week after application; consequently, although sufficient copper is present in a normal season to check the weak development of fungi, it does not suffice in an abnormal season (where the moisture on leaves is considerably in excess) to inhibit fungus attack.

A second feature is that in New Zealand dust costs at least three times as much as sprays, whereas in America the cost is only slightly in excess of sprays, and as considerably greater quantities are required, the practice is really too expensive, despite the considerable saving in time and labour, for our conditions.

A third feature is that, as bordeaux is seldom prepared correctly, dusts have often shown better results in experiment than would normally be the case if hydrated-lime bordeaux were used (which eliminates the uncertainty of faulty preparation), and for this reason many of the field experiments conducted overseas cannot be considered reliable.

—Mycological Laboratory, Plant Research Station.

BUSH-SICKNESS INVESTIGATION.

NOTES ON SOME RECENT RESULTS.

B. C. ASTON, Chief Chemist, Department of Agriculture.

THE area now known as the Mamaku Demonstration Farm was acquired in 1912 by purchase for the purpose of investigating the deficiency disease called "bush sickness," which was hindering the development of a very large area of country quite capable of growing healthy pasture but which would not grow healthy ruminants (cattle and sheep). This particular disease exists in varying degrees of severity on many areas in the North Island situated in various positions from sea-level to 2,000 ft.

The Mamaku Farm represents an area which may be roughly computed at 50,000 acres of country, originally densely forested, and remarkably uniform in vegetation, physical features, and history. Timber-milling was the main industry of this area, situated about 1,760 ft. above sea-level, of almost flat land, intersected by a network of tram-lines for getting out timber, and crossed by the Auckland–Rotorua Railway. On maps the area may be located as part of the Patatere Plateau, which has been referred to as the Mamaku Plateau. As might be expected, the winter conditions of this inland elevation are fairly severe, and must be counted an added condition antagonistic to the health of stock weakened by malnutrition.

Thus, although there may be areas more severely afflicted with bush sickness than Mamaku, the climatic conditions in these areas are generally milder, so that Mamaku may be accepted as a useful experimental area with easy means of access by rail and road, and any method of treatment found successful would be applicable to a far wider area than that represented by the Mamaku Farm.

DEVELOPMENT OF DAIRYING AT MAMAKU.

Dairying has been carried out on the demonstration farm for the last sixteen years. Land has been stumped, ploughed, and cropped, and over 100 acres of improved pasture has been established. This is top-dressed with phosphates from time to time, the favourite dressing being a mixture of slag and superphosphate, the slag supplying a considerable percentage of iron. Under this treatment it has been a matter of general remark that the older paddocks are becoming more healthy for stock, and it is now considered that stock may be carried on some of them without treatment of a special nature to combat the bush sickness.

During the past year a number of pasture-samples have been drawn from the old improved paddocks, and these show more than twice the quantity of iron that samples show on the untreated paddocks or on bush-sick lands in the vicinity. The accompanying table shows the results of analyses. The alumina content of the sample is an indication of the extent to which it is contaminated by soil. One would therefore regard No. 6648 as undoubtedly showing more iron than is contained by the plant.

Analyses of Pasture Samples from Mamaku and Rotorua Areas.

Results are expressed as percentages. Chemical analyses are calculated on the material dried at 105° C.

Lab. No.	Date taken.	Manurial Treatment and Remarks.	Locality.	Ash.	Soluble Ash.	Silica (SiO_2).	Iron (Fe).	Alumina (Al_2O_3)	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Manganese (Mn).	Chlorine (Cl).	Nitrogen (N).	Carbon Dioxide (CO_2).	Botanical Analyses.		
																Grasses.	Legumes.	Weeds.
		Old improved Paddocks at Mamaku, and healthy Paddocks at Te Ngae.																
6647	16/11/29	Dressed in past with super, and last three years annually with 3 cwt. super and slag per acre (1:1). No. 3 paddock	Mamaku Farm	8·66	7·95	0·71	0·027	0·025	1·20	0·97	0·43	0·023	0·83	4·60	..	73	26	1
6798	27/3/30	Down ten years. Last two years dressed with 3 cwt. super and slag; had four dressings during previous eight years. No. 2A paddock	Mamaku Farm	10·17	8·71	1·45	0·020	0·046	1·05	0·81	0·41	0·022	1·06	4·64	..	90	10	0
6799	27/3/30	1927: Crop swedes with 1½ cwt. super and slag. 1928: Crop oats with 1 cwt. blood-and-bone and some kainit. March, 1929: Sown in grass with 3 cwt. super and slag; dressed in November, 1929, with same mixture. No. 7B paddock	Mamaku Farm	10·87	9·07	1·80	0·020	0·052	0·95	0·71	0·39	0·031	1·29	4·46	..	92	7	1
6801	27/3/30	Had 3 cwt. super, three and a half and one and a half years ago. Haystack paddock, extremely free from sickness	Te Ngae	10·71	7·28	3·43	0·017	0·043	0·47	0·83	0·50	0·019	0·92	3·37	..	75	23	2
		Newer Paddocks at Mamaku and Elsewhere.																
6648	15/11/29	Unmanured paddock ..	Mamaku Farm	8·03	6·28	1·74	0·013	0·110	0·65	0·60	0·37	0·036	0·78	3·90	..	90	8	2
6797	27/3/30	2 cwt. super in spring and autumn, 1929. Old lupin paddock. Growth after cutting for hay	Te Pu ..	8·89	7·40	1·49	0·009	0·056	0·74	1·57	0·48	0·024	0·68	3·58	..	69	30	1
6800	27/3/30	Unmanured paddock ..	Mamaku Farm	9·96	6·85	3·11	0·013	0·035	0·62	0·48	0·35	0·048	1·07	3·65	..	96	2	2

Analyses of Pasture Samples—continued.

Lab. No.	Date taken.	Manurial Treatment and Remarks.	Locality.	Ash.	Soluble Ash.	Silica (SiO_2).	Iron (Fe).	Alumina (Al_2O_3)	Phosphoric Acid (P_2O_5).	Lime (CaO).	Magnesia (MgO).	Manganese (Mn).	Chlorine (Cl).	Nitrogen (N).	Carbon Dioxide (CO_2).	Botanical Analyses.		
																Grasses.	Legumes.	Weeds.
								Newer Paddocks at Mamaku and Elsewhere—continued.										
6802	12/3/30	5 cwt. spathic iron ore January, 1930. Spathic iron paddock No. 6	Kaharoa	9·62	7·02	2·60	0·011	0·035	0·48	0·91	0·47	0·033	1·06	3·38	..	72	23	5
6803	12/3/30	In 1927 and again in 1928 had 3 cwt. Nauru phosphate, 1 cwt. sulphur, ½ cwt. sulphate of iron. October, 1929, 3 cwt. Nauru, ½ cwt. sulphur, ½ cwt. sulphate of iron. No. 4 paddock	Kaharoa	9·79	7·81	1·97	0·011	0·031	0·87	1·04	0·42	0·035	1·10	3·89	..	68	28	4
6823	13/3/30	Super only. No manure for three years. No iron applied. Control paddock	Kaharoa	9·74	6·72	3·02	0·010	0·045	0·49	0·89	0·48	0·051	1·06	2·60	..	77	19	4
6926	6/11/29	Unmanured paddock ..	Te Pu ..	9·16	7·63	1·53	0·010	0·043	0·59	1·18	0·45	0·032	1·06	3·05	..	69	16	15
								Pure Species free from Soil Contamination.										
77	10/2/30	Top dressed with 2½ cwt. super and slag. White clover sown autumn, 1929. Next old super paddock. Shut up for few weeks after having been cut for ensilage. Clean, green growth	Te Pu ..	8·70	8·26	0·44	0·010	0·023	0·90	2·43	0·41	0·021	0·42	4·43	..	..	..	..
2062	10/2/30	Red clover; clean, green, young growth. Paddock shut up for three weeks. Old super paddock	Te Pu ..	10·40	10·03	0·37	0·009	0·022	0·91	2·57	0·72	0·020	0·64	5·16	2·95	..	..	..
2063	10/2/30	Red clover. Same paddock as No. 77 (white clover)	Te Pu ..	9·37	9·11	0·26	0·008	0·025	0·85	2·99	0·57	0·016	0·31	4·93	2·85	..	..	..
4057	14/5/30	Cocksfoot; green manure paddock. 2 cwt. super, autumn and spring, 1929	Te Pu ..	11·12	8·17	2·94	0·011	0·047	1·51	0·61	0·46	0·048	1·19	4·43	..	..	..	..
4062	10/2/30	Cocksfoot; old super paddock. Same as 2062	Te Pu ..	9·96	7·13	2·83	0·008	0·023	0·89	0·98	0·53	0·029	0·103	3·41	0·88	..	..	..

Analyses by F. B. Thompson and P. H. Sykes.

Experiments with Sheep.

It is a well-known fact that in some areas bush sickness does not affect cattle, but that sheep suffer badly, which may be interpreted as a sign that such land is less bush-sick than that on which cattle cannot be continuously pastured. There are very large areas which are what naturally would be considered suitable sheep-country—tussock land, danthonia, and scrub country—but on which, nevertheless, sheep cannot be raised.

It is satisfactory to state that experiments which have been under way over six months on a block of this type of country near Rotorua where the runholder has been unable to raise his lambs hitherto are now indicating that it will be economically possible to treat all the sheep (some 1,800 in this case) with a lick composed of salt and native iron carbonate, and that as a result the sheep can be kept healthy and the lambs raised successfully.

It may be recalled that an experiment with sheep at the Mamaku Farm (see this *Journal* for July, 1930, page 10) proved that a small flock of sheep going sick after a year's grazing could be brought back to health by means of iron and ammonium-citrate pellets and pastured for a further year, enabling them to be sold fat. There is no doubt that this success was due to the iron treatment. In the mass experiment at Rotorua, mentioned above, the treatment was with a large mob of sheep and carried out on the farm of a practical runholder with an iron remedy obtained locally. The control animals are becoming completely bush-sick, while the mob of lick-treated sheep and the smaller lot of pellet-treated sheep are doing well at the date of writing (27th November, 1930). The experiments are under the supervision of Mr. C. R. Taylor, Analyst's Assistant, stationed at Rotorua. As a very large area of this class of country occurs from Rotorua to the coast, wherever there is a light porous topsoil, runholders having any difficulty with malnutrition in sheep akin to bush sickness should watch for the complete report to be published in the *Journal*.

Another method of automatically administering the iron remedies to stock is by incorporating them with hay or ensilage when either of these is being made, and a number of experiments are being undertaken by Mr. Taylor in this direction.

Importation of Stud Stock from Abroad.—Owing to conditions regarding foot-and-mouth disease in Great Britain (states the annual report of the Live-stock Division for 1929-30) a prohibition still exists on the importation of cattle, sheep, and swine from there, and up to the present it has not been possible to take steps to lift the embargo. At present the only countries from which cattle may be imported into New Zealand are Tasmania, Canada, and the United States (with the exception of the State of California), while swine may be introduced only from Tasmania and Canada. Cattle and swine from these countries must be quarantined on arrival in the Dominion. The following imported animals were placed in quarantine during the year for the prescribed period: Horses, 1; cattle, 41; sheep, 7; swine, 4; dogs, 44.

BOYS' AND GIRLS' AGRICULTURAL CLUBS.

RECORD OF ACTIVITIES IN 1929–30 SEASON.

(Continued.)

2. Otago and Southland Districts.

J. E. DAVIES, Instructor in Agriculture, Dunedin.

LOCAL crop competitions for boys and girls were inaugurated in Otago early in 1919 under the auspices of the Otago Expansion League, and have been continued annually in co-operation with the local Farmers' Unions and Department of Agriculture. In the initial stages, however, competitions were limited to comparatively few districts, due to the fact that there did not exist a controlling organization working solely in the interests of an agricultural club movement. The agricultural club activities in Southland have reached a high status, largely due to the encouragement and energy of the controlling committee. The associated clubs have now completed their second season's work, and judging by the large number of entries in the wide range of competitions it appears that the Association is working on a progressive basis.

SOUTHLAND.

CALF-REARING COMPETITION.

The inauguration of a calf-rearing competition received consideration by the executive, and it was, in the first place, resolved to defer this class of competition to the 1930–31 season. So keen, however, was the desire of members in the dairying districts for the establishment of calf-clubs that it was eventually decided to start a few, mainly with the object of procuring information for the launching of a suitable scheme the following year. Clubs were accordingly formed in the Makarewa, Kennington, Edendale, and Wyndham School Districts. A total of thirty-eight calves which were the offspring of purebred bulls and born between 1st and 31st October, were entered in the competition. All the calves were tattooed to avoid the possibility of substitution taking place.

Judging of the calves was carried out at various school centres during the latter part of February, Mr. R. H. Dickie and Mr. G. W. Wild, late Instructor in Agriculture, Invercargill, being the judges in all districts. For the purpose of uniformity, calves were paraded in two classes—(1) large breeds (Friesian and Shorthorn), (2) small breeds (Jersey and Ayrshire). The maximum standard of judging points was: Condition, 40; dairy type, 35; record chart, 25. At all centres keen interest was evinced at the judging parades, and, in addition to the presence of competitors, teachers, pupils, and parents, a large number of farmers attended, which augurs well for the future of this phase of club work. At the parades demonstrations on dairy type, and short talks on the management and rearing of calves, &c., were given by the judges. That the competitors had tended their animals with care to feeding and management was depicted in the excellent condition of the animals and their docility when on parade, and the judges had some difficulty in placing the winners.

Substantial cash prizes were awarded to the three placed competitors in each class. Olive Dunn, Edendale School, with a total of 90 points out of 100, secured the championship, and was the winner of the Reginald MacKinnon Trust medal awarded for the highest aggregate points in the competition. Edward Callighan, Makarewa School, was given second place with 89 points. Both calves and the feeding record charts were a feature of a special display at the Invercargill Winter Show. Special prizes were given for most points in condition and dairy type only, and most points in record keeping.

CALF-JUDGING PARADE AT EDENDALE SCHOOL, FEBRUARY, 1930.

The calf owned by Winnie Smith, Wyndham, was judged the winner, while Herbert Dunn, Edendale, carried off the honours with an excellently kept feeding record.

CROP-GROWING: POTATOES AND MANGELS.

The potato-growing competition inaugurated in 1928–29 was repeated in last season's programme. Provision was also made for a mangel-growing competition, and although mangels are not grown to any great extent in Southland the possibilities of this crop were deemed worthy of consideration. The competition was divided into two divisions for the purpose of equalizing the disparity in competitors' ages. The Intermediate Division included competitors over twelve and under sixteen years of age, and the Junior Division was for those under twelve. The plots for the former were $\frac{1}{40}$ acre and for the latter $\frac{1}{70}$ acre. In both divisions the variety of mangel grown was the same —namely, Prizewinner Yellow Globe; but in the potato-growing competition the varieties differed, being Up-to-Date for the Intermediate and Arran Chief for the Junior Division.

Some phenomenal potato-yields were recorded. The number of plots abandoned were comparatively small when seasonal conditions are taken into consideration, most of the plots having suffered severely by frosts experienced in December. It was gratifying to note the number of plots which were sprayed as a preventive against blight. The mangel plots were rather late in being sown, and in several districts

were almost ruined in the early stages by heavy hailstorms, but although the average yield was low the quality of the roots was excellent.

Summary of Results.

Number of schools entered, 66; number represented at final judging, 58.

Number of competitors entered: Potato-growing, 358; finally judged, 276. Mangel-growing, 40; finally judged, 25.

Total number of plots ruined by weather conditions, stock, ill health of competitors, &c., 98.

Heaviest-yielding crops: Potatoes—Up-to-Date, 32 tons 2 cwt. per acre; Arran Chief, 30 tons 16 cwt. per acre. Mangels, 56 tons 5 cwt. per acre.

Average per acre yield of crops: Potatoes—Up-to-Date, 12·8 tons; Arran Chief, 14·2 tons. Mangels, 30 tons.

Approximate total area and value of potato crop: Area grown, $5\frac{1}{2}$ acres; yield, $74\frac{1}{4}$ tons; estimated value of table and seed potatoes (68 tons), £500.

In the potato-growing competition each division was divided into five groups, and in the mangel competition into two groups. As in the calf-rearing competition, cash prizes were again awarded to the three placed competitors in the Intermediate Division and to the four placed competitors in the Junior Division. In the crop competition alone a total of forty-nine cash group-prizes were awarded.

Trophy Winners.

Since the inception of agricultural-club activities in the Southland District the Stuart Wilson Dominion Challenge Cup for annual competition has on both occasions been awarded to competitors in the potato-growing competition, the 1929-30 season's winner being James Glynn, Eastern Bush School, an Intermediate Division competitor who grew an outstanding crop of Up-to-Date potatoes yielding at the rate of 32 tons 2 cwt. per acre, exceeding the preceding year's record by 17 cwt. The actual per-acre returns on grading were: Table, 16 tons 5 cwt.; seed, 14 tons 8 cwt.; pig, 2 tons 9 cwt. When assessed on a basis of table £6, seed £5, and pig £1 per ton, the calculated value of the crop was £171 19s. per acre. The cup was displayed at a presentation function held at the school in October, and the Fields Superintendent, Dunedin, presented the winner with the Department of Agriculture's gold medal and a photograph of the cup.

The silver shield of the Southland Council of the New Zealand Institute of Horticulture, valued at £30, awarded to the school gaining the highest average aggregate points in the practical field-work in the crop-growing competition, was won by Lora Gorge School with $59\frac{1}{4}$ points, closely followed by Knapdale School with $58\frac{1}{2}$ points.

The Southland Provincial Farmers' Union shield, valued at £12 12s., for the school gaining the highest average aggregate points over all phases of work in crop-growing, was won by the Knapdale School with $85\frac{1}{2}$ points, Lora Gorge School being close second with $84\frac{1}{2}$ points.

Championships (Also Winners of the Reginald MacKinnon Trust Medallions).

The championship results were as follows :—

	Yield per Acre. Tons cwt.	Total Points.	Place.
Potato-growing :—			
Intermediate Division—			
Adrian Miller, Gore	20 9	89½	1st
Reta Moir, East Chatton	17 3	88¾	2nd
Junior Division—			
Eric Middleton, Lora Gorge	17 3	89½	1st
James Patterson, East Chatton	22 4	89	2nd
Mangel-growing :—			
Intermediate Division—			
Lex Gerrard, Winton	56 5	89½	1st
Spence Parcell, Seaward Downs	40 19	87¾	2nd
Junior Division—			
Murray Cushen, Edendale	39 16	85¼	1st
Vernon Pont, Colac Bay	34 1	84¾	2nd

Special Prizes.

Special prizes were awarded as follows :—

Potato-growing : Most Points in Field-work :—
Intermediate Division—Charles Grace, Redan, 49 points (maximum 50).
Junior Division—Charles Tapper, Waimatua, 49½ points.

Best Record Chart.

Intermediate Division—Reta Moir, East Chatton, 29½ points (maximum 30).
Junior Division—William Smith, Waikaka Valley, 27¼ points.

Mangel-growing : Most Points in Field-work :—
Intermediate Division—Spence Parcell, Seaward Downs, 49 points (maximum 50).
Junior Division—Raymond Evans, Long Bush, 49½ points.

Best Record Chart.

Intermediate Division—Herbert Dunn, Edendale, 28¾ points (maximum 30).
Junior Division—Gordon MacKenzie, Redan, 26½ points.

Judging of Crops.

The initial judging of plots in regard to cultivation, management, and appearance was carried out during the month of February by supervisors and teachers of each school district, who jointly inspected each plot and submitted a standardized progress report thereon. Following this, during March and early April, a minimum of the two best plots in each school district was inspected and reported on by the Instructors of the Agriculture and Education Departments, and all progress reports were standardized accordingly.

The large number of potato plots to be weighed for yield points caused the Association considerable concern, and to overcome this difficulty a scheme was evolved under which standard instructions were issued to supervisors and teachers to dig a representative area and forward the quota of potatoes therefrom to Dunedin, where each competitor's lot was weighed and graded. Accompanying each lot a declaration form was submitted giving full particulars as to width of drills, &c. The scheme has much to commend it, proving economical with a standard system of weighing and grading.

The mangel crops were left until June and weighed in the field, all weighing being carried out by Instructors of the Agriculture

Department. Crops were judged on a maximum point basis of cultivation, 20; general appearance, 30; and records, 30. For the purpose of eliminating the differences in soil-variation the following system of allotting yield points was adopted: Potato crops, 1 point for each ton up to 12 tons, and $\frac{1}{4}$ point for each succeeding ton; mangel crops, 1 point for every 3 tons up to 36 tons, and $\frac{1}{4}$ point for each succeeding 3 tons. For example, a yield of 12 tons of potatoes per acre received the same number of points as a yield of 36 tons of mangels per acre—namely, 12 points. This method proved excellent, and was most successful in deciding trophies awarded for most points in crop-growing.

The outstanding feature of the season's work was the marked improvement in record-keeping. Out of a maximum of 30 points an average of 20·4 points were obtained over the 300 competitors, as against an average of 13·5 points over the 147 competitors in the previous season. The crop-growing organization is now becoming fully understood, and it is the intention of the executive to further extend this work so as to cover the main field-crops.

Otago District.

Club activities in Otago were confined to a potato-growing competition in the Milton district, which was controlled by a local committee organized by the Milton Farmers' Union in conjunction with the Department of Agriculture and Otago Expansion League.

All competitors were grouped in one class, the size of the plots was $\frac{1}{40}$ acre, and they were judged on a similar basis to that of the Southland district. Maximum points were allotted as follows: Cultivation, 20 points; general appearance and management, 30; records 10; yield, 50. The variety of potato grown was Arran Chief. Twenty-two competitors entered. Keen interest and excellent field-work was shown throughout the year, but the record keeping left much to be desired.

The following competitors gained the winning places:—

	Yield per Acre. Tons cwt.	Points (Maximum 110).	Place.
Hazel Bain	22 14	101¾	First.
James Wood	21 9	101¼	Second.
William Lyon	23 19	100	Third.
Ian Finch	20 15	99¾	Fourth.

The highest yield was 24 tons per acre, and the average yield 16 tons 5 cwt. per acre. Appropriate valuable prizes, all of which were donated by the Otago Expansion League, were awarded to the winners.

A display of the activities of agricultural-club work was made at both the Invercargill and Dunedin winter shows. Further, both the agricultural and pastoral associations included in their schedules classes for club members. The club sections never failed to attract the attention of show visitors, and, apart from their educational value, such displays will certainly be the means of winning many new members.

General.

In addition to the prizes already mentioned, donations have been received by the Southland executive from the following: Reginald

MacKinnon Trust Fund, Invercargill; L. Evans, Long Bush; Southland Education Board; R. Dickie, Tuturau; Peter Anderson Trust Fund, Gore; Farmers' Union, Woodlands; and subscriptions from forty adult members.

The movement is now firmly established in the South, and the excellent co-operation existing between competitors, parents, teachers, supervisors, instructors, judges, and the controlling executive has been the means of establishing a strong bond among all concerned.

WOOL RESEARCH IN NEW ZEALAND.

LAST year wool investigatory work was apportioned between the Massey and Canterbury Agricultural Colleges by the Wool Advisory Committee of the Scientific and Industrial Research Council. The progress of the work is summarized in the annual report of the Research Department for 1929–30 as follows:—

(1) In breeding experiments a beginning has been made in the study of the inheritance of wool characters in the New Zealand Romney. These experiments have reference especially to thickened tip, including hairy tip, and to harshness.

(2) One convenient method has been found for obtaining a numerical measure of thickened tip and hairiness. In the course of this work various facts about the wool samples studied were brought out that could hardly have been discovered without counts and measurements.

(3) Experiments with differential shearing have provided a definite case of medullation being influenced by environmental conditions.

(4) A detailed study is in progress of the fibre-types and their development. This is the most fundamental part of the biological work, and should provide the basis for many breeding and other experiments.

During the year, practical liaison was effected with the British Research Association for the Woollen and Worsted Industries, and results of all the investigations conducted by the staff of the association at Torridon and elsewhere will henceforth be available to the Committee. In view of the considerable extent and marked progress of the investigations conducted by this association, this connection is one of much value to local research workers.

Advantage was taken of this arrangement to secure representative samples of Romney fleeces grown throughout New Zealand, and after selection and retention of duplicates these have been forwarded to Torridon for examination and report. The defects in the character of New Zealand Romney wool, as alleged by English manufacturers, have so far proved somewhat elusive and ill defined, and this means of ascertaining the full nature of the defects, and possibly remedial measures, is being resorted to.

It will be to the ultimate advantage of the New Zealand wool industry to supply material of the particular quality required by manufacturers. The facilities offered by the Research Association for the Woollen and Worsted Industries are therefore being availed of, to give indications as to possible improvements desirable in our wool in order to better fit it for spinning purposes.

In order that the investigations at Torridon may be followed closely and the maximum advantages derived from them, and in order to ascertain to what uses Romney wool is being put by English manufacturers, Mr. D. J. Sidey, B.Ag., of the staff of Canterbury Agricultural College, has been sent to England.

The Committee, being fully aware of the complexity and of the importance of the wool problem as affecting the Dominion, has decided to follow a cautious policy and to acquire the fullest information on the whole subject before launching a comprehensive scheme of research. The work undertaken so far has therefore necessarily been largely of an exploratory nature.

The Wool Committee consists of Dr. C. J. Reakes (Chairman), Mr. W. Perry, Professor G. S. Peren, Professor R. E. Alexander, Mr. A. H. Cockayne, Mr. E. Short, Dr. F. W. Dry, and Mr. Q. Donald.

SEASONAL NOTES.

THE FARM.

The Pastures.

At times poor results are obtained from the autumn sowing of pasture-seed mixtures. One of the causes of this is the sowing of the seed too late on in the season; another is insufficient preparation of the seed-bed. Both of these factors may originate from the same cause—commencing the preparatory cultivation of the seed-bed at too late a date.

The seeds used in pasture mixtures are all relatively small. Generally the most economic means of obtaining the fine tilth in the soil that small seeds call for is to allow plenty of time between the initial cultivation of the land and the sowing of the seed. This enables the influence of aeration to assist in breaking up the soil and the production of the mellow, well-consolidated condition of the soil that it is difficult, if not impossible, to obtain by preparatory cultivation of short duration. From this it follows that many of those who contemplate the sowing of pastures in the autumn should soon be attending to the matter of providing suitable seed-beds—seed-beds in which great numbers of the small seeds will not be buried so deeply that they will have but small chance of pushing their shoots up into the light.

In the laying-down of permanent pastures, which it is intended shall not be broken up again for as long a period as possible, it is surely desirable to use nothing but the most suitable seed and ample amounts of it, for the influence of any weakness in this respect will probably endure for years. Hence the casual manner in which pasture seeds at times are purchased naturally causes one to wonder. For permanent pastures it may be taken as a rule, with few exceptions, that poor seeds are dear at any price. By poor seeds are meant those unsuited for the purpose for which they are used. Each year pasture seeds poor in strain or poor in germination capacity find purchasers, thereby providing evidence that some farmers at least do not realize the true economy of good seeds even though they be relatively costly.

The matter of quality in pasture seeds should be considered well ahead of the time when the seed is to be sown, in order that there may be ample time for the selection of lines of suitable strain and good germination. Recent research has stressed the fundamental importance of strain, particularly when the best known methods of pasture utilization are to be adopted. By long experience it has been established that the germination-capacity of seeds should be tested, and, in view of this, official testing of farmers' samples is carried out free of charge by the Department of Agriculture. The position is summed up in the fact that hurried purchase of pasture seeds cannot be depended upon to give satisfactory results. An important function of the Fields Division is the tendering of advice, when requested, in regard to the composition of pasture-seed mixtures.

When hay or silage has been saved from a field it will often respond profitably to a dressing of superphosphate, especially if the herbage is mown while still somewhat immature and if the fertilizer is applied as soon as the mown material has been removed. The quick stimulation of growth which can at times be obtained by the use of superphosphate in this manner gives a greater aftermath of fresh feed which is particularly valuable in view of the critical stage at which it becomes available—that is, when supplies of fresh grass are apt to be scant.

Generally care should be taken to avoid the production of seed by recently sown pastures during their first year, and this care is especially necessary if the seed mixtures that have been used were designed for the production of permanent swards and so contained seeds of slow-developing as well as of relatively quick-developing species. If seed production is allowed to take place in the early stages when such mixtures have been used, poor establishment of the valuable slower species may be expected.

At times it will prove advantageous to allow areas of thin worn-out grassland to run to seed in the summer, provided the sward on such areas contains reasonable quota of species of which it would be worth while to have reseeding. If this is done the areas should be drastically harrowed in the autumn when the seed has ripened and when rains sufficient to safely establish the seedlings may be expected. Under favourable circumstances this practice may prove valuable as a means towards a denser sole of grass, especially when for some reason ploughing up of a weak turf is either not desirable or not possible. When ploughing and regrassing are practicable they frequently form the most satisfactory means of obtaining improved swards.

Basic Importance of Cultivation.

There is at this season much cultivation work which will require attention. Cultivation is certainly only one of the links in the chain of factors which beget good crops, but the point which must not be overlooked is that if cultivation is the weak link there is only one thing which can be done to increase the strength of the chain. That one thing is to fortify the cultivation link.

Systematic observation has taught that the free use of suitable fertilizer and the sowing of the best possible seed in ample quantities are effective or ineffective according to the efficiency of the cultivation work. An obvious and important result of cultivation is the suppression of weeds. Its value in this connection is great, because weeds so readily rob crops of their supplies of moisture and direct sunlight which are essential to growth. Before passing from this aspect it may be remarked that the greatest harm done by weeds is the cutting-off from the crops of their supplies of sunlight. When the supply of direct light is cut off crops cannot satisfactorily feed, even though plant-food may be in the soil in great abundance. A survey of the methods of those farmers who participate in crop competitions throws an interesting light on the value of cultivation in the suppression of weeds. These farmers frequently grow mangels or carrots after such crops as mangels, carrots, or potatoes, and obtain splendid yields when they do so. Such a practice could not be adopted with any satisfaction unless the first crop of this type in the series were made a " cleaning crop " in fact as well as in name. Too often the crops which in theory are cleaning crops in reality bring about fouling of the land with weeds. Cultivation is the key to the growing of true cleaning crops.

Weed-suppression is the obvious effect of summer cultivation, but it is only one effect. Other effects, though not so obvious, are at times equally or even more important. One of these valuable effects is the hindering of the escape of soil-moisture by evaporation from the surface. When the surface layer is kept loose by cultivation moisture escapes from the soil freely only through the leaves of the crop growing on the soil. Hence summer cultivation if carried out early enough assists in creating reserves of soil moisture which will prove of value during dry periods. This effect of summer cultivation is of particular moment in the extensive portion of New Zealand which is characterized by an annual rainfall of 35 in. or less.

Cultivation is of further value because it brings about soil aeration which sets up changes that make it possible for crops to obtain from the soil certain essential substances which otherwise could not be used by the crop and which would be in short supply.

Summer cultivation is the particular concern of all those farmers who grow mangels, potatoes, carrots, turnips, and swedes, and similar crops grown in rows wide enough apart to allow of intertillage.

Preparatory cultivation, as distinct from intertillage, for crops such as swedes, which are still to be sown will in many instances be calling for attention. If preparatory cultivation is inadequate, then efficiency in other respects will not win the fullest possible reward.

Utilization of Special Summer Feed.

Frequently when special summer feed has been grown to supplement the pastures, a start with the feeding of it is not made early enough in the case of " wet " stock. On many farms from about Christmas onwards the pastures are allowed to become so woody that they no longer, by themselves, provide suitable rations for such stock. Many farmers, however, are deceived by the amount of herbage on the fields into believing that the requirements of the stock are being well met. Actually the stemmy pastures are deficient in respect to digestibility and faulty in regard to their balance of nutritive substances, and the only way to provide a really good milk-producing ration is to feed leafy or non-woody herbage by using special crops such as young green lucerne, fresh aftermath of grass, or early sown quickly maturing soft turnips. Only by doing this will unduly heavy falling-off in butterfat production be avoided if the pastures have been allowed to become stemmy. In summer poor quality in feed is probably a more frequent cause of undue falling-off in yield than is poor quantity. Poor quantity is remedied because it is recognized ; poor quality is sometimes allowed to continue to operate because it is not recognized.

In ordinary practice the best summer feed for calves is short, fresh, clean grass which contains a well balanced, highly digestible supply of the nutritive substances required for growth, whereas rank grass-growth is very apt to be badly balanced, and to be deficient in the mineral compounds which are vitally essential for the production of strong constitution and good bodily development. Hence a special effort should be made to arrange for the calves to have the run of short, fresh pasture. Should it be necessary to supplement the pastures by the feeding of roots, it is well to bear in mind that roots are at times deficient in mineral content so far as growing stock are concerned, and that the deficiency in this respect usually can be remedied readily by the feeding of a relatively small portion of bran.

Because of the invasion of weeds, young lucerne may require mowing towards the end of January. It is better not to mow young lucerne so early unless weeds are threatening to outgrow the lucerne plants and to thereby harmfully restrict their supply of light and moisture. If cutting is necessary it should not be done too closely.

Unless unusually dry conditions prevail it is usually profitable to top-dress lucerne with superphosphate, at the rate of 2 cwt. to 3 cwt. to the acre, after it has been mown in midsummer. Super applied at this stage will benefit practically nothing except the lucerne, whereas fertilizer applied in the spring may benefit not so much the lucerne as invading plants, such as rye-grass, the suppression of which is most desirable.

If soft turnips are being carted out to stock it is usually desirable to scatter them well over the field in which they are being fed, so that droppings will be evenly deposited ; but if the fertility of a particular area requires building up, then it will probably be well to concentrate the feeding-out of the roots on that area.

Often the earlier sown rape crops will be ready for feeding off in January. It is usual to feed off the crop in small blocks. Lambs on rape should have a good run-off on pasture, and when the feeding of the rape is being commenced they should be allowed on it only for a short time.

In order to obtain the best return from millet, feeding of it should start when the crop is 6 in. to 8 in. high. When it is fed at this stage of development it will subsequently stool out and give a valuable second growth.

Forage-crop Considerations.

Often in January it is possible to estimate whether an adequate supply of forage for the winter and early spring is in sight, and if it is decided that the supply is likely to be insufficient there is still time to increase the provision. One may grow a late summer or early autumn sown temporary pasture with 20 lb. of Italian or Western Wolths rye-grass and 4 lb. or 5 lb. of red clover, to the acre. This must be sown early to make certain that it will yield a substantial supply of winter feed, and it can be counted upon under average circumstances to yield a heavy hay or silage crop in the following season. When the land available for emergency winter-feed production will be required for spring sowing, then instead of a temporary pasture Algerian oats or black skinless barley should be sown; both require about 2½ bushels of seed per acre. Often the fullest possible return from autumn-sown temporary pastures or cereals for green feed is not obtained because sowing is not done early enough. This is especially the case in the South Island.

If turnips and swedes have not been sown by New Year, this should be done at the earliest opportunity; Hardy and Imperial Green Globe are turnips suitable for January sowing. In most places after the middle of January it is safer to sow turnips rather than swedes, because the turnips develop more quickly and do not suffer so severely as swedes from the summer and autumn ravages of insect pests. Both turnips and swedes will usually respond profitably to a fertilizer dressing at the rate of 2 cwt. to 3 cwt. per acre. In such a dressing superphosphate should be prominent, and often bonedust can be profitably included. The autumn-sown cereals and temporary pasture can be depended upon to respond profitably to a dressing of 2 cwt. or 3 cwt. per acre of super.

Thinning of such crops as mangels and carrots should be pushed on if this has not already been given attention, and if the seedlings are pale and leave the impression that they have had a setback they will probably respond profitably to a dressing of about 1 cwt. per acre of nitrate of soda scattered along the rows close to the plants and hoed in after thinning has been completed.

—R. P. Connell, Fields Division, Palmerston North.

THE ORCHARD.

Maintenance of Spray Controls.

THE main and most important operation in the orchard during the coming month will be that of sound and consistent spraying, in order to maintain controls against diseases and pests on fruit and trees. Codlin moth will again be on the wing in large numbers, so that it becomes imperative to keep the fruit completely covered with a film of lead arsenate.

It is suggested that summer dilutions of emulsified oil combined with Black Leaf 40 may with advantage be experimented with on a limited scale for control of codlin moth, red mite, and bronze beetle. It is reasonable to expect that this solution may act as a deterrent to moths depositing eggs, or even destroy eggs already deposited, thereby eliminating a certain proportion of the stung apples which are often found even when arsenate of lead has been thoroughly applied. The effect of the spray as a control of bronze-beetle and red-mite should also be beneficial. The most susceptible period for black-spot may be regarded as over after New Year,

enabling the grower to extend the period between applications; but this extension should not be practised unless dry weather prevails.

During the dry summer months heavy dews at night are often experienced, a form of moisture which is probably more conducive to the germination of fungus spores on fruit and foliage than rain, which has the action of circulating or entirely removing the spores from where they may be lodged. The danger from moisture in the form of dew particularly applies to the late summer, when the pin-spot form of black-spot of apple and pear is so often in evidence. The easing-up of the lime-sulphur programme is also a factor which enables red-mite to increase to a marked degree during January and February. In this case special preventive measures should be taken by the application of sprays as recommended in last month's notes.

Thinning.

This operation should soon be completed. In the case of apples it is recommended that the removal of the centre or crown fruit should commence the process, in order to relieve the pressure on the surrounding apples, especially with short stalked varieties, and also to open up the clusters to facilitate the penetration of spray solutions. This method of thinning will largely prevent the seclusion sought by bronze-beetle and leaf-roller caterpillar in the clusters of fruit. Subsequent thinning should be mainly directed towards the removal of fruit which is diseased or otherwise defective for marketing.

Cultivation.

General cultivation of the orchard for conservation of moisture should be continued not only to supply the moisture demanded by the tree for maintenance of growth, but also so that the manure which has been incorporated with the soil may function to the maximum extent. The relation existing between the action of artificial fertilizers and soil-moisture is often not fully appreciated or understood by orchardists.

Growth of long grass and weeds immediately under the trees which have not been removed by power or horse implements should be dislodged by hand tools and dragged towards the centre of the rows, to be killed by exposure to the sun and in the process of general cultivation. The destruction of undesirable growth under the trees also removes the egg and larva stage of the bronze-beetle, exposes fungus spores to the destructive action of light and dry winds, and removes material in which codlin moth may pupate for the following season.

Preparations for Export.

Special efforts should be made during the coming month to complete the arrangements for export. Case-making should be finished, and quantities of packing material checked against requirements for the prospective crop (which should not be difficult to estimate at this period), in order to avoid the inconvenience and vexation caused by shortages of material when shipment is in progress.

—M. Davey, Orchard Instructor, Mapua.

Citrus Culture.

Cultivation: Every opportunity should be taken to carry on with this work. Should conditions become dry the citrus trees would very soon suffer through lack of moisture. At this period of the year trees are producing their maximum growth; moreover, as the fruit is setting and developing, every assistance should be given to the trees. Where a fine tilth has been provided all moisture will be conserved, and this will assist the trees to give the maximum results. Fruit development and wood-production places considerable strain upon the resources of the trees,

and nothing should be left undone that will assist them to function in a proper manner. The failure of so many trees to return anything like a reasonable return is because correct and proper attention has not always been given to them.

Manuring: A study should be made of individual trees, their habits and their needs, and treatment given accordingly. This applies particularly to any feeding that is required. At this period of the year, when the young fruit is placing extra strain upon the trees, a little assistance should be given in the way of sulphate of ammonia—say, 2 lb. per tree.

Young planted trees: Any check received by the young tree in the first season is often reflected for a number of years. It may be that there are superfluous young shoots that require to be either rubbed off altogether or pinched back. This should not be neglected. However, it may be possible to err in the direction of pinching too much during the first year. Discretion should be used, and every encouragement given for the trees to produce a reasonable amount of wood growth upon which can be built a strong and vigorous tree that will in time produce regular crops of fruit.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Preparing the Cockerels for Market.

Although hatching is now over for the season, and the bulk of the chickens have passed the real danger period, next month will prove to be a busy time for the poultry-keeper from the fact that the maximum amount of stock the plant can carry will be on hand. In addition to this the young birds are rapidly developing and are daily making greater demands on the accommodation available; further, hot trying weather may be experienced.

In view of these circumstances good and careful management, particularly in regard to the growing birds, is imperative if they are to avoid receiving a set-back. Overcrowding should be prevented at all costs. To lessen the risk of this and its evil effects, the weeding-out of every bird that is not likely to show a profit over its keep is a matter which the poultry-keeper cannot afford to ignore. Particularly is this the case with cockerels, for unless these are marketed when they reach an age of four and a half to five months they may easily show a loss instead of a profit. The birds should be made to rapidly lay on flesh by good feeding and management, and be in a prime condition at the age mentioned. The fact should not be forgotten that it costs less to produce a pound of flesh than a pound of frame, and that it will pay to prime poultry just as it pays to prime other classes of live-stock.

When a cockerel reaches an age of between four and five months it commences to grow its adult feathers, and obviously it cannot be expected to produce these and put on flesh at the same time. Even under the most careful and effective management the margin of profit from cockerels is small, but if kept until the chicken stage has passed or later the profit will be reduced accordingly. Clearly the consumption of food will be increased, due to the greater growth of plumage, bone, &c., necessary for the development of an adult bird; but this is not the only drawback, for even if a fully developed cockerel is marketed in an absolutely prime condition it does not appeal to the poulterer, to whom it is known as a "stag." The fact of its having a well-grown, sharp spur reduces its value as a table bird. Generally such a bird is coarser and larger than is desired for the high-class trade—in fact, it is usually classed as a boiling-fowl.

A weakness on many plants in developing the market cockerel lies in providing it with only a bare living diet, or with a mash chiefly made up of greenstuff, boiled potatoes, &c. As a means of reducing the cost of production these cheap foodstuffs may be sparingly included in the ration, but the best results cannot be obtained unless the greater bulk of the ration consists of wholesome grain material. The following mash and other feeding is recommended after the priming process has commenced: Equal parts by measure of wheat-meal, maize-meal, and bran, the whole being moistened with milk or soup, and mixed into a crumbly mass. Feed three times a day all that the birds will clean up. Green food should be fed separately during the day. Where milk is available this should be given in large quantities to drink.

Pale Yolks and Blood Spots.

A poultry-keeper advises me that for some time past he had disposed of his surplus eggs to a private customer well in advance of current prices, but lost these sales owing to the yolks being more or less pale in colour, while some of the eggs contained blood spots. It was considered by the purchaser that this condition of the eggs was an indication that the fowls which produced them were affected with disease. The fact of a bird laying such eggs, however, does not necessarily indicate that it is affected with any form of disease. In the first place an odd egg containing a blood spot may be produced on the best managed of plants and when the stock are in a healthy thriving state. It must, however, be admitted that blood spots are much more frequently produced where the birds are being forced for egg-production by means of rich food such as meat, meat-meal, condiments, &c.

Blood spots or clots in eggs are generally due to a rupture of a small blood-vessel near the ovaries in the envelope enclosing the ripe yolk, or in the upper part of the egg duct. With white-shelled eggs blood spots, however small, can be easily detected by testing before a light, when a deep red colour will be noticed. With brown-shelled eggs a blood spot is not so easily detected, as the shell colour, even in a normal egg, causes its content to appear more or less red when under the testing process. Where it is discovered by testing that eggs with blood spots are being produced the birds which produced them should be located by means of trap-nests and then disposed of.

Yolk colour is largely influenced by the food supplied to the birds. The inclusion in the ration of yellow maize, lucerne, clover, carrots, watercress, meat, or milk will tend to produce rich-coloured yolks. Reference is now made to those cases in which the birds are being kept under confined conditions, as it is well known that eggs containing pale yolks are seldom or never produced where birds are provided with a free range and natural conditions generally. It is unfortunate that the case in point is only one of many where the sickly appearance of the yolks of eggs from birds confined in a yard, without any vegetable matter and animal food, has discouraged the use of eggs and consequently reduced the demand for this product. Obviously such conditions will continue until the market value of eggs is fixed according to quality, including colour of yolk and size of air-cell (this latter being an indication of age), rather than on the doubtful lines now obtaining on the markets.

What applies to egg quality applies in like degree to their size, as the demand is not likely to be increased if the top price is demanded for an egg weighing about $1\frac{7}{8}$ oz. or less, which is commonly the case at present. If the necessary reforms are to be brought about in this direction the consumer has his part to play. In the first place he should demand eggs of undoubted quality, and, secondly, that they be uniform in size and be sold according to their weight per dozen. Just as purchase by weight is bound

to come, so will quality enter into the market value of eggs. Only then will the producer be encouraged to place in the hands of the consumer tested eggs of uniform size, branded as a guarantee of quality; while in turn the consumer will be induced to eat more eggs and likewise pay the full market value for the superior article.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Control over Breeding.

ONE of the most important factors in the successful practice of modern apiculture is securing control over the breeding, and this can be obtained by compelling the bees to build whatever comb is desired.

Under natural conditions, or when in hives and allowed freedom to construct combs, bees invariably build a large proportion of drone-comb, which is subsequently utilized for breeding drones. Some drones are needed for the impregnation of young queens, and usually a sufficient number for the purpose will be bred even when the breeding of them is restricted by making the fullest use of worker comb-foundation. The comb-foundation obtained from manufacturers is impressed with the bases of worker-cells, and by the use of full sheets good worker-combs are usually obtained. However, accidents may happen to the combs; portions of the foundation may break away under the weight of a good swarm, and other portions sag and stretch, owing to the comb-foundation being carelessly fixed. In such circumstances the bees will quickly build drone-comb, and thus destroy the purpose for which the foundation was originally designed.

The replacement of such combs is a matter of urgency, otherwise countless drones will be raised and the toll on the stores gathered by the workers will result in the ultimate returns from the hive being considerably curtailed. The beginner will be loath to remove the combs containing drone-cells, on account of the presence of worker-brood. To reduce the number of drones being reared he will be tempted to bring into use drone-traps, which hamper the access of the worker-bees to the hives, or he may elect to destroy the cappings on the cells. Such measures are ill advised, and cannot be counted upon to successfully remedy the drone trouble. The most effective way to prevent the rearing of drones is to remove the combs containing the drone-cells. This may be accomplished by removing the combs from the centre of the brood-nest to the side of the hive, or by placing them in a super over an excluder. When the worker-brood has hatched the combs should be removed altogether.

After-swarms.

The beekeeper should give some little attention to the prevention of after-swarms. These swarms are a nuisance, and weaken the parent hive without being of much value in themselves. If the colonies are left undisturbed they will swarm freely, and all chance of a surplus is lost.

Among the many plans practised for their control the most successful is that which provides for removing the parent hive. This method is an excellent one, and will usually prevent the issue of the small swarms. As soon as the swarm is hived the parent hive should be removed to a new location in the apiary, and put the swarm on the old stand. The effect of this change is to strengthen the swarm with the field bees which are absent gathering nectar, and correspondingly to temporarily weaken the old hive, so that it will rarely put out a second swarm. The emerging bees in the parent colony will soon provide sufficient workers to ensure a

surplus, and the tendency to swarm will not be so prevalent. In order to make the operation more successful the parent colony should be examined for queen-cells, and they should all be removed save two.

After-swarms should always be returned to the parent colony unless they are required for increase. In the latter case it is a good plan to dump two or three swarms together, and thus form a strong colony that will gather sufficient stores to carry on through the winter. In dumping shake the swarms on to an excluder placed between the supers, so as to take out the young queens. Before returning an after-swarm overhaul the parent hive and cut out all the queen-cells. Place two or three empty combs or frames fitted with sheets of foundation in the brood-chamber, and put the brood over an excluder to hatch out. In case the colony contains a virgin queen the combs, before being placed over the excluder, should be shaken in front of the hive to make sure that the virgin queen is not confined above the excluder, or she will not get mated, and a drone-raising colony will be the result. A good plan at all times is to provide an opening for the bees between the super and the brood-chamber, which can be done by inserting a small block of wood immediately under the edge of the super. This will allow the bees to fly freely, and in case the virgin queen is by accident confined to the super an opportunity will be given her to fly and get mated. Likewise the drones can pass out of the super. If on making a later examination the queen is discovered in the super, she can be placed in the brood-chamber under the excluder.

Foul-brood.

As advised last month, beekeepers should not fail to treat diseased colonies where found. This work should be carried out in advance of the main flow, so that undivided attention may be given to securing a crop. Over and over again the treatment of disease is delayed until such time as the season is advanced, and as a result the affected colonies do not count as producers in the main crop; whereas if treatment is carried out as soon as nectar is being freely secreted these colonies will be in good heart to produce a surplus. When in doubt as to the presence of disease it is advisable to forward a sample of the comb addressed to the Director of the Horticulture Division, Wellington, or to the district Apiary Instructor, for examination.

Queen-excluders.

The season is at hand when it is advantageous to use queen-excluders. During the height of brood-rearing, and in order not to cramp the queen, she should be allowed the full use of the super, so that large numbers of worker-bees may be raised to work the main crop. It is not wise to bring the excluders into use too early, and never until such time as the bees are working freely in the super. By cramping the queen fewer bees are produced, and small returns will be netted. Every encouragement must be given the queen to lay to her utmost, and by so doing populous colonies will be produced.

The best time to put the excluders on the hives is when the main flow sets in and the bees are busy bringing in nectar. Too many beekeepers make the mistake of putting on the excluders when the supers are first placed on the hives, and it is not an easy matter to get the bees to work in the supers even if combs of honey are raised from the brood-chamber, as excluders tend to make the passage between the lower story and the upper more difficult. Before placing the excluders make a careful examination of the colony to note its condition, and to take stock of the number of frames of brood in the hive. If the brood-chamber is full of brood the combs may be manipulated so as to provide the queen with ample room for laying during the period which follows. The best plan is to place the majority of frames of capped brood over the excluder, and to substitute

empty combs, taking care to see that the queen is confined below. As the bees hatch out over the excluder they will become accustomed to passing through it, and as fast as the cells become vacant they will be filled with honey. If eggs are raised with the brood care must be taken to see that the bees do not raise queen-cells, for in the latter case the hive may swarm out, leaving one or more virgins in the top story, and these queens, being confined to the hive, cannot get out to be mated, and will eventually develop into drone-layers. Within one week after raising the brood examine the combs in the super to note if any queen-cells have been raised. If any are found they must be destroyed.

The advantage of the use of queen-excluders is in saving labour at the time of extracting, by doing away with the work of picking over the combs. Much time is lost in this operation, and extracting is retarded when everything should be hurried. It is only by the use of excluders that bee-escapes can be employed, and in many seasons, depending largely on the weather, these have to be brought into use.

Treatment of Swarms—Provision of Supers.

There is a little doubt in the minds of many beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless supers are given to strong early swarms from ten to fifteen days after they are established these colonies will often swarm again, and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey.

When a swarm has been established a few days a quick examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required. Nothing works so well as a swarm under proper treatment, and the attention given in providing supers will amply repay the beekeeper.

Queen-rearing.

In last month's notes attention was directed to queen-rearing. Every effort should be made to requeen the apiary during the working season, so that the colonies will go into winter quarters headed by a good queen. It often happens that the beekeeper is dissatisfied with his stock, in which case his best plan is to send direct to some reliable breeder and secure a number of good queens. Whether this suggestion is carried out or not, when raising queens the beekeeper should select the best stocks in his apiary; in other words, queens should be raised from queens whose bees have a record as honey-producers.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Tomato Crops.

THE crop under glass is now being harvested, and owing to the late development of the outdoor crop the demand should be well maintained. Where heat is available, and the pot system of growing the plants is adopted, a fresh crop is now started so as to be ready to take the place of the present crop, which will finish about the month of February. For this work under glass nothing is more important than a good strain of seed, and every care should be taken to get it. When it is obtained a four or five years' supply of seed may be harvested, as its vitality can be relied upon for that period.

Reference was made last month to progress in equipping the heated glasshouse; the progress in economical and efficient management is very marked. A report is now to hand from Hamburg, Germany, that experiments have been carried out in heating these houses with hot air instead of hot water. One of the oldest systems of heating was by means of flues passing through the house, and thus raising the atmospheric temperature by means of the heat given off from the surface of the flue. One of the most modern is to plug in a number of small electric heaters, a method that is useful to meet the exigencies of a cold snap. The experiment referred to is an application of a heating principle, long in use in Central Europe, but one that has been extended and adapted to meet modern requirements. The principle is to create a draught over the surface of a hot stove and deliver the heated air through ducts to the places required. Stove-heating has been popular in dwellings in cold climates, but the heat has been badly distributed. By the new method the vicinity of the stove is no warmer than the more distant parts of the chamber, as the heated air is drawn off the surface of the hot iron as soon as it is created.

This equipment consists of a wrought-iron stove enclosed in an outer metal covering. Cold air is drawn in below between the stove and the cover, heated, and then drawn off the top and liberated through the glasshouse by means of ducts and an electric fan. The large Hamburg establishment where the system was installed found that tomatoes ripened earlier than in houses where the hot-water system was in use. The simplicity of the system makes it attractive, and the results obtained are encouraging. Perhaps some one with the pioneering spirit may care to try it.

The crop of tomatoes grown outside commences to ripen towards the end of January. It will be interesting to see the decisions put into operation for a measure of standard packing as passed by the last conference of growers. If this progressive movement is general it will be a great contribution to an orderly method of marketing, which is so indispensable when perishable goods have to be boxed and shipped to a distant market.

Small Fruits.

As the crops are gathered summer pruning should be completed. Strawberry beds should be cleaned up and manured ready to take advantage of the autumn growing period to build up the constitution of the plants for a good crop next summer.

In the case of raspberries and loganberries it is specially desirable to cut out the cropping canes as soon as the crop is gathered, and to burn them. This is the most effective contribution to the control of pests and diseases in these crops. It also facilitates the ripening of the young canes for the next season's cropping, and the application now of such sprays as may be required.

Market Garden Crops.

The early potato crop is now being lifted, but crops of the later varieties will not ripen for another three or four months. The fungus disease known as "late-blight" (*Phytophthora infestans*) usually commences to make its appearance at this time, and is the cause of considerable anxiety to growers of late crops in the wetter districts or during a wet season. Under such circumstances a bordeaux spray should now be applied. The usual strength is the 4–4–40 formula — 4 lb. bluestone, 4 lb. rock lime (quicklime), and 40 gallons water. There are some important points about making this mixture, some of which are as follows: Dissolve the bluestone in a wooden or earthenware vessel, as it corrodes most metals and is spoiled by some. Dilute the ingredients before mixing them; the materials then easily remain in suspension, and the mixture is strongly adhesive and thus

protects the plants for the maximum period. Wrongly mixed a coarse precipitate is formed, which is difficult to keep in suspension and the mixture has poor adhesion. These are some of the reasons for being particular. The right way is just as easy and quick as the wrong way, and has at least twice the efficiency. Another point is that the spray should be used the same day as it is mixed, because it loses adhesion with keeping. Five pounds of washing-soda may be used in the place of 4 lb. of quicklime. The application should be repeated after two or three weeks and continued as may be necessary. Sometimes the solid ingredients are increased after the first application, as much as 5 lb. or 6 lb. each of bluestone and lime being used.

If the grower is lifting a clean crop of early potatoes that are true to name, seed should be selected from them; the opportunity is too good to miss. If the crop has been patchy or diseased it is best passed over for seed. The virus diseases that may be infecting the tubers cannot be observed at this stage.

Last month's market garden notes have now a special application in the warmer areas. The very important crop of spring cabbage maturing about the month of September should be sown about the middle of January in the coldest parts of the country. In other districts it is deferred for a month.

The Homestead Garden.

Smooth lawns and smart well-trimmed hedges look well in the vicinity of the dwelling. Hedges will now require attention; this feature is by no means the easiest to maintain, and a great deal of consideration is necessary to keep them looking well. The tendency is to allow hedges to bulge, especially at the top, where they become wide with branches thickly interlaced, the base being bare or scantily clothed with foliage. Most hedges should now be trimmed, and in doing this the sides should be made to lean together in a wedge shape as far as possible. This develops a narrow top and broader base, which looks well and provides shelter and protection where it is required—low down.

Climbing plants, with all their varied habits, and trees and shrubs trained as espaliers, require careful training and summer pruning at this time. Chiefly this is done to check vigorous growth in directions where it is not required. To do this the tip of the growing shoot is pinched out or superfluous shoots are rubbed off altogether. Careful manipulation of this kind during the growing season is the method of controlling a number of kinds of vines and climbers. New growth that is to be encouraged should be carefully tied in. Rambler roses after flowering should have the old wood cut away at the surface of the ground, and as much of the young growth as may be required carefully secured. If young wood is scarce canes may be flowered the second season by shortening the laterals in the spring.

—*W. C. Hyde, Horticulturist, Wellington.*

Water Content of Export Butter.—During the year ended 31st March last 156,967 churnings of butter were tested by the Dairy Division for water content, the average percentage of water being 15·32, as compared with 15·29 for the previous year. Churnings over the legal limit of 16 per cent. amounted to 0·5 per cent., and these were returned to the respective factories to be reworked with drier butter.

Analyses of Sodium Chlorate in Different Forms.—Some supplies of sodium chlorate have arrived in New Zealand in the crystal state and others in powder form. Samples analysed for the Fields Division gave the following results as regards purity: Crystals, 99·8 per cent.; powder, 98·5 per cent. The balance in each case was ordinary chloride.

REVIEW.

The Soils of Irrigation Areas in Otago Central : Bulletin 33 (New Series), New Zealand Geological Survey, by H. T. Ferrar. Government Printer, Wellington, 1929. Price—paper cover, 10s. ; quarter cloth, 12s. 6d.

UNTIL fairly recently soil surveys have received little attention in New Zealand, despite the almost universal acknowledgment that a properly conducted survey of soil types is of great assistance not only to the geologist, but to the agriculturist, forming, as it does, a basis for the economic utilization of the lands under survey. Mr. Ferrar's work is therefore all the more appreciated, and the bulletin under review may be summed up as a valuable contribution to the literature dealing with this semi-arid region of New Zealand.

The mapping of some 1,177 square miles of the irrigable area of Central Otago has been admirably executed. The publication is the result of nearly three seasons' work, and contains forty-two pages of letterpress, illustrated by a number of photographic plates, together with a key map and sixteen soil maps. The maps evince scrupulous care in compilation, and possess a wealth of detail which reflects the greatest credit on their compilers. The soil-classification falls into five well-marked series containing one or more of the several classes, such as clay, silty loam, sandy loam, sand, and gravel, which are subdivided into soil types according to situation with respect to facilities for irrigation and drainage. The classification has been carried out on broad and simple lines, and the soil types have been adequately described in the text accompanying the maps.

The bulletin deals with many aspects of Central Otago, including a discussion on irrigation problems and a description of the district in general, with its fauna and flora. A few minor discrepancies have been noted in regard to the latter, particularly the statement that " around Arrowtown ragwort (*Senecio jacobaea*) covers large areas and has become a noxious weed." In point of fact, no ragwort exists in the district, obviously St. John's wort (*Hypericum perforatum*) being meant.

Dealing with the subject of " Irrigation Problems," the author in small compass endeavours to summarize and advise on some of the chief problems relating to irrigated agriculture, and here a few points seem to call for comment. Particulars are given in regard to the water requirements of the Great Basin region of America, but definite figures relating to Central Otago would have been valuable and could have been readily obtained. Again, few well acquainted with the former and now-existent conditions of Ida Valley will agree with the author's statement that this area is not becoming waterlogged, and that the intrusion of rushes is not to be regarded as of great moment in that they afford shelter for sheep in winter.

It is gratifying to find that the author has investigated the question of " alkali " soils, and his conclusion that " in Central Otago alkaline salts exist in the soil, but not in amounts great enough immediately to endanger the irrigation projects," is heartening. However, the insidious nature of alkali accumulations, which have been responsible for the ruination of many irrigation schemes in other parts of the world, will require careful watching in Central Otago.

In regard to the purpose of the survey the author makes some rather wide claims for such work. When it is stated that " a soil survey, therefore, seeks to differentiate classes of land according to some factor that has a preponderating influence upon crop-production, and to record upon a map the areas occupied by each class, in order that production may be increased in the most economical way," the impression is left that the growing of crops successfully is purely dependent upon soil type. Soil

type, however, is only one factor in successful crop-raising, and within general soil-types exist great variations which cannot be recorded and yet which have considerable effect upon the growing of crops. Again, the remark that "the purpose of the soil survey of irrigation areas in Otago Central is to supply maps that indicate how irrigation water can best be distributed over the land, or removed if drainage is necessary, and at the same time supply information with regard to the special problems from irrigation," cannot be altogether accepted. It must be added, however, that the author remarks: "This survey is not a final investigation. It does not show what areas will best repay irrigation and what quantities of water will be required."

In conclusion, it may be remarked that the principal object of the work—namely, a survey of the soils of the irrigation areas of Central Otago—has been well and faithfully carried out, and the bulletin is commended to all students of soil problems.

R. B. T.

CROP AREAS AND YIELDS, SEASONS 1928-29 AND 1929-30.

Crop.	1928-29.		1929-30.	
	Area.	Average Yield per Acre.	Area.	Average Yield per Acre.
	Acres.		Acres	
Wheat—				
Grain	255,312	34·60 bushels	235,942	30·68 bushels.
Chaff, &c.	1,272	1·79 tons	1,491	1·29 tons.
Oats—				
Grain	73,101	41·93 bushels	67,722	44·33 bushels.
Chaff, &c.	194,638	1·71 tons	190,072	1·65 tons.
Barley—				
Grain	19,500	40·06 bushels	18,229	41·42 bushels.
Chaff, &c.	340	2·27 tons	402	2·05 tons.
Maize—				
Grain	8,986	50·78 bushels	7,957	47·50 bushels.
Ensilage	295	3·59 tons	695	3·75 tons.
Peas (for threshing) ..	17,893	29·48 bushels	9,855	29·86 bushels.
Beans (for threshing) ..	170	25·29 bushels	171	21·13 bushels.
Linseed (for threshing)	2,800	8·30 cwt.	7,757	9·07 cwt.
Rye-grass seed—				
Perennial	21,536	415·50 lb.	24,366	407·74 lb.
Western Wolths and Italian	4,807	487·22 lb.	5,719	507·71 lb.
Cocksfoot seed ..	11,255	182·04 lb.	11,729	171·37 lb.
Chewings fescue seed ..	9,506	286·46 lb.	9,808	246·37 lb.
Crested dogstail seed ..	5,702	223·92 lb.	3,404	243·51 lb.
Red clover and cow-grass seed	9,750	197·60 lb.	4,703	221·14 lb.
White clover seed ..	3,338	169·68 lb.	3,710	163·04 lb.
Other grass and clover seeds	2,123	114·93 lb.	3,446	91·01 lb.
Grass and clover hay ..	320,299	1·92 tons	380,898	2·12 tons.
Lucerne hay	30,808	2·62 tons	31,690	2·57 tons.
Potatoes	21,304	5·77 tons	23,214	5·60 tons.
Green fodder crops ..	219,088	..	203,438	..
Turnips	479,994	..	475,254	..
Mangolds	9,914	..	10,519	..
Onions	880	12·07 tons	870	11·80 tons.
Hops	608	1,274·24 lb.	598	1,409·46 lb.
Tobacco*	1,000	..	1,073	..

* Outside borough boundaries.

CERTIFICATION OF PERENNIAL RYE-GRASS.

GROWERS OF CERTIFIED MOTHER SEED.

As a result of trials on the produce of the 1929–30 perennial rye-grass harvest, the following growers are recorded as having areas deemed fit for the production of Certified Mother Seed :—

Name.	Address.	Area.	Name.	Address.	Area.
Hawke's Bay.		Acres.			Acres.
Allen, A. W. ..	Tomoana ..	42½	Percival, T. S. ..	Mahora ..	34
Allen, J. L. ..	Raupare ..	30	Person, Mrs. ..	Hills Road, Fernhill	6
Anderson, F. W. ..	Twyford ..	4½			
Asch, W. Van ..	Tuki Tuki ..	62	Pickering and Hackett	Waiohika ..	10
Bridgman, J. ..	Mahora ..	35	Ramsey Bros. ..	Haumoana ..	14
Bridgman, T. ..	Mahora ..	10	Robertson, J. ..	Haumoana ..	26½
Bridgman, S. G. ..	Haumoana ..	16	Rosser, C. ..	Pakipaki ..	97
Britten, Mrs. ..	Pukahu ..	4	Rule and Wilkins ..	Raupare ..	19
Burge, H. J. ..	Twyford ..	4	Simson, E. M. ..	Tomoana ..	70
Burge, H. W. ..	Twyford ..	5	Sissons, W. H. ..	Longlands ..	12
Burgess, T. ..	Meeanee ..	69	Smith, A. H. ..	Poukawa ..	17
Burns, H. H. ..	Twyford ..	73	Smith, E.	Twyford ..	30
Burns, W. F. M. ..	Richmond Road, Hastings	12	Speers, A. ..	Longlands ..	12½
			Speers, G. J. ..	Pakipaki ..	10
Clarke, H. H. R. ..	Waiohika ..	25	Stead, W. G. ..	Flaxmere, Raupare	22
Couper, E. D. ..	Maungatereteré	40			
Crawford, H. ..	Havelock North	10	Stewart, H. N. ..	Haumoana ..	71
Currie, T., sen. ..	Twyford ..	13	Struthers, A. ..	Longlands ..	25
Elliot, D. H. ..	Haumoana ..	34	Struthers, J. ..	Pukahu ..	35
Emmerson, T. ..	Raureka ..	8½	Symes, A. F. M. ..	Longlands ..	75
Fernie, D. ..	Pakowhai ..	90	Tait, T.	Twyford ..	15
Frogley, R. ..	Maungatereteré	20	Tattersall, C. E. ..	Pakowhai ..	69
Frost, G.	Twyford ..	11	Taylor, W. ..	Pukahu ..	8
Gimblett, W. J. ..	Ngatarawa ..	7	Thomson, H. ..	Pakipaki ..	16
Gregory, R. ..	Clive ..	12	Thompson, J. B. ..	Mahora ..	21
Griffiths, R. ..	Twyford ..	23	Thompson, J. B. ..	Karamu ..	10
Haldane, C. ..	Raureka ..	48	Todd, R. H. ..	Otane ..	40
Harris, J. H. ..	Hastings ..	9	Wake, A. E. ..	Pukahu ..	5
Harris, J. H. ..	Haumoana ..	30	Wall and McLeod ..	Tomoana ..	40
Heeney, Mrs. ..	Mahora ..	31½	Wall, W. J. ..	Karamu ..	7
Heynes, W. ..	Clive	18	Wall, H. H. ..	Manutuke ..	9
Hickson, A. ..	Fernhill ..	14	Wellwood, R. A. ..	Mahora South ..	22
Hill, A. E. ..	Mahora ..	11	Wright and Wallace	Hastings ..	8
Hope, J.	Omahu Road, Hastings	11	*Poverty Bay.*		
Hunter, J. G. ..	Haumoana ..	8	Baird, Wm. ..	Waerengaahika	22
Lascelles, P. W. ..	Maungatereteré	37½	Baird, Wm. ..	Bushmere ..	94
MacDonald, James ..	Meeanee ..	124	Bolton, V. S. ..	Waerengaahika	30
McDonald Bros. ..	Havelock North	10	Bryson, M. ..	Patutahi ..	22½
MacNamara, D. ..	Pakowhai Road, Hastings	2	Doulton, J. E. ..	Manutuke ..	9
			Fisken, R. C. ..	Matawera ..	20
Masters, A. J. ..	Twyford ..	41½	Gray's Estate ..	Hexton ..	14
McLean, A. (Estate)	Twyford ..	41	Habgood, F. ..	Patutahi ..	25
McLeod, H. ..	Hastings ..	53	Hamon, Mrs. H. ..	Waerengaahika	28
McLeod, W. ..	Pakipaki ..	8	Jones, T. R. ..	Ormond ..	9
McNab, J. A., jun. ..	Twyford ..	5	Lawless, D. ..	Manutuki ..	12
McNab, J., sen. ..	Twyford ..	13	Mullan, B. ..	Waerengaahika	5
Merrit, — ..	Pakowhai Road, Hastings	15	Mullan, B. P. ..	Waerengaahika	10
			Roach, J.	Makauri ..	8
Millar, Max ..	Pakowhai ..	14	Scott, Mrs. C. ..	Makauri ..	6
Milne, C. W. ..	Maungatereteré	4	Sheriff, A. E. ..	Ormond ..	13
Moore, R. H. ..	Waerengaahika	6	Taylor, J. ..	Ormond ..	15
Otene, Taha ..	Tomoana ..	23	Turnbull, A. J. ..	Makauri ..	10
Parsons, P. ..	Meeanee ..	48	Witters, G. ..	Matawera ..	25

—J. W. Hadfield, Agronomist, Plant Research Station.

Cidermaking.—The annual production of cider in the Dominion (reports the Horticulture Division) stands at approximately 50,000 gallons, of an estimated value of £12,500. The bulk of the cider produced is of first-class quality, and finds a ready market. This industry offers considerable room for further extension on a profitable basis, especially in the main commercial fruitgrowing districts.

WEATHER RECORDS: NOVEMBER, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

For the third month in succession, for the Dominion as a whole, the weather in November was the coldest experienced since the taking of records commenced. It was also very stormy, westerly or south-westerly gales being of frequent occurrence. Thunder and hail storms were rather numerous also. In consequence of the adverse conditions the season is relatively even more backward than at the end of October. Growth of vegetation generally has been poor. All crops are reported to be in a backward state, and the prospects for the hay crop in particular are in most districts the reverse of bright. The cutting of ensilage has commenced in parts of Auckland Province where the growth of feed has been fair. Stock appear to be in fair condition generally, but there have been some losses of sheep, principally in connection with shearing.

Rainfall.—The rainfall, generally speaking, was above or below average, according to whether or not the district concerned normally receives most of its rainfall in westerly weather. In the eastern portions of Wellington Province, in Hawke's Bay, and in most of Auckland there was considerable deficit. On the north-west side of the East Cape Peninsula, between East Cape and Opotiki, some places had an excess. South of Auckland, about as far inland as the Waikato River, the rainfall was in general considerably above the average. The same is true, also, as regards Taranaki and Western Wellington, the area of heavy rainfall extending beyond the main range into the western parts of the Wairarapa. In the South Island a wet month was experienced on all the West Coast and in Otago. In Canterbury and Marlborough conditions varied, some parts having more and some less than the average, the drier parts tending on the whole to have a deficit.

Temperature.—The mean temperature was the lowest recorded for November at Waihi, Tauranga, Hamilton, New Plymouth, Wellington, Christchurch, and Waimate. At Auckland, Napier, Nelson, and Dunedin, though the month was cold, lower temperatures have been recorded previously. There were no days of exceptional severity, but numbers that were very cold and none that were very warm. Several frosts occurred, those of the 24th and 28th being the heaviest. The latter did considerable damage to small crops in Wairarapa and Hawke's Bay. There were further falls of snow on the ranges, that of the 23rd extending to fairly low levels.

Storms and Pressure Systems.—Until the 27th westerly weather prevailed, and between the 9th and 26th the type was very pronounced. This is a feature common in spring, but which has been less conspicuous than usual during recent years. V-shaped depressions advanced from the west at frequent intervals. The passage of the trough or line of lowest pressure was generally accompanied by squally southerly changes, of which the most pronounced occurred on the 6th, 8th, 13th, 15th, 19th or 20th, 23rd, and 26th. The depressions which passed on the 13th, 15th, 19th, 23rd, and 26th were all deep, and each produced widespread rain, with heavy falls in places, and very rough weather. Barometers were particularly low between the 13th and 19th, and thereafter recovered only gradually. Boistrous westerly gales did some damage at Auckland on the 15th. On the 19th some of the streets of Greymouth were flooded owing to a local downpour. The depression of the 26th had a cyclonic centre in its northern portion, the track of which passed close to the southern border of Nelson Province. Except for parts of the eastern districts of the South Island, heavy rain was almost general on this date. Severe floods occurred in the Hutt Valley and at Otaki.

On the 28th a very intense anticyclone moved on to the Dominion, barometers rising to over 30·5 in. The weather from then till the end of the month was controlled by this anticyclone and was a marked improvement on that of the preceding fortnight.

RAINFALL FOR NOVEMBER, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	1·83	17	0·50	3·10
2	Russell	1·52	10	0·50	2·41
3	Whangarei	1·40	10	0·30	2·97
4	Auckland	3·11	21	0·54	3·33
5	Hamilton	4·09	14	1·18	4·10
5A	Rotorua	4·10	14	0·68	4·17
6	Kawhia	4·14	17	0·92	4·54
7	New Plymouth	5·50	21	0·88	4·73
8	Riversdale, Inglewood ..	11·31	22	2·80	9·12
9	Whangamomona	..	..	..	7·38
10	Eltham	4·03	18	0·90	4·48
11	Tairua	1·52	12	0·32	4·01
12	Tauranga	2·86	16	0·63	3·36
13	Maraehako Station, Opotiki	5·20	16	1·06	3·13
14	Gisborne..	1·21	7	0·50	3·00
15	Taupo	3·09	14	0·84	3·48
16	Napier	1·39	8	0·65	2·50
17	Hastings	2·27	7	1·00	1·75
18	Taihape	4·78	17	0·85	3·55
19	Masterton	2·12	10	0·87	2·79
20	Patea	5·48	19	1·27	3·99
21	Wanganui	3·50	15	0·53	3·28
22	Foxton	4·23	19	1·00	3·26
23	Wellington (Karori Reservoir)	4·14	13	1·56	3·21
	South Island.				
24	Westport	11·47	25	2·11	8·85
25	Greymouth	10·89	25	1·40	9·01
26	Hokitika	12·03	23	2·06	10·80
27	Ross	14·46	21	2·64	14·15
28	Arthur's Pass	..	..	..	16·34
29	Okuru	15·23	18	2·87	13·03
30	Bainham	15·57	21	2·71	13·51
31	Nelson	3·19	14	0·63	3·03
32	Spring Creek	2·89	11	0·65	2·50
33	Tophouse	6·08	20	1·08	6·72
34	Hanmer Springs	3·93	11	1·09	3·07
35	Highfield, Waiau	2·94	7	0·92	2·56
36	Gore Bay	1·80	6	0·88	2·22
37	Christchurch	1·18	9	0·57	1·95
38	Timaru	1·50	12	0·42	1·95
39	Lambrook Station, Fairlie ..	1·54	6	0·64	2·03
40	Benmore Station, Clearburn	2·26	13	0·77	2·10
41	Oamaru	1·81	11	0·68	1·93
42	Queenstown	3·88	14	1·06	2·74
43	Clyde	1·89	11	0·61	1·35
44	Dunedin..	4·82	20	0·78	3·27
45	Wendon	4·96	17	0·90	2·77
46	Gore	..	..	..	3·23
47	Invercargill	6·68	25	1·30	4·37
48	Puysegur Point	9·22	25	1·18	8·28
49	Half-moon Bay	6·56	21	1·03	5·81

—*Edward Kidson, Director of Meteorological Services, Wellington, 5/12/30.*

LIVE-STOCK IN NEW ZEALAND, 1930.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1929–30.	Number of Lambs tailed, 1929–30.	Sheep (including Lambs) as at 30th April, 1930.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	31,312	67	541,424	237,022	7,667	1,045,170	467,459	1,225,114	75,746	796	3,133
Auckland	45,124	9	876,171	409,506	12,025	1,492,546	863,713	1,655,813	156,648	2,398	6,767
Gisborne	18,315	48	344,564	36,907	2,884	2,994,460	1,319,139	3,241,907	19,183	1,092	3,476
Hawke's Bay ..	15,098	..	239,846	49,742	2,483	3,060,524	1,632,119	3,304,016	15,231	2,348	6,692
Taranaki	18,984	1	400,439	209,163	7,091	926,655	477,115	994,049	51,806	135	4,461
Wellington	39,090	28	710,450	199,423	7,794	5,607,591	3,057,632	6,207,360	70,682	575	786
Nelson	6,437	1	67,521	26,436	1,472	395,934	176,929	478,117	13,787	1,274	629
Marlborough	6,687	9	46,430	15,273	828	1,053,683	474,331	1,168,060	6,333	728	3,040
Westland	2,148	..	42,999	12,082	740	71,097	51,913	88,095	6,143	1	396
Canterbury	57,312	42	185,185	72,867	2,089	4,779,740	3,023,573	5,751,940	42,577	148	67
Otago	32,006	5	137,553	51,335	2,873	3,451,991	1,891,144	4,074,223	18,104	19	159
Southland	24,682	8	173,086	69,116	3,503	2,120,019	1,452,532	2,652,593	11,553	..	7
Dominion totals ..	297,195	218	3,765,668	1,388,872	51,449	26,999,410	14,887,599	30,841,287	487,793	9,514	29,613
Totals 1929 (or 1928–29)	298,986	237	3,445,790	1,291,204	79,859	25,295,560	13,855,958	29,051,382	556,732	8,590	25,636

—*Census and Statistics Office.*

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are estimates of the current season's lambing in New Zealand computed from estimated average percentages furnished by Inspectors of Stock. Corresponding figures for the five previous years, together with the actual number of lambs tailed therein, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1930 ..	9,312,461	83·19	7,747,274	..
1929 ..	8,820,536	87·56	7,723,523	7,817,177
1928 ..	8,211,878	84·61	6,948,380	7,286,284
1927 ..	7,905,432	87·28	6,899,861	7,114,057
1926 ..	7,503,200	84·35	6,329,338	6,459,775
1925 ..	7,463,735	85·64	6,391,812	6,345,218
		SOUTH ISLAND.		
1930 ..	8,251,714	84·43	6,967,041	..
1929 ..	7,787,619	89·87	6,998,691	7,070,422
1928 ..	7,322,173	87·74	6,424,887	6,569,674
1927 ..	6,926,298	86·17	5,968,979	6,064,915
1926 ..	6,445,052	84·79	5,465,361	5,609,906
1925 ..	6,251,488	78·61	4,914,046	5,090,562
		DOMINION.		
1930 ..	17,564,175	83·77	14,714,315	..
1929 ..	16,608,155	88·65	14,722,214	14,887,599
1928 ..	15,534,051	86·09	13,373,267	13,855,958
1927 ..	14,831,730	86·76	12,868,840	13,178,972
1926 ..	13,948,252	84·57	11,794,699	12,069,681
1925 ..	13,715,223	82·43	11,305,858	11,435,780

District Estimates.

The following table gives estimates of the current (1930) season's lambing for the several sheep districts :—

Sheep District.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.
Auckland	1,865,690	89·26	1,665,441
Napier-Gisborne	3,858,525	74·97	2,891,938
Wellington - West Coast ..	3,588,246	88·89	3,189,895
Marlborough-Nelson-Westland	809,400	71·68	580,235
Canterbury-Kaikoura ..	3,663,071	86·49	3,168,226
Otago (including Southland)	3,779,243	85·16	3,218,580
Dominion	17,564,175	83·77	14,714,315

—*Live-stock Division.*

Exportation of Stud Stock.—During the year ended 31st March, 1930, the following stud stock was exported : Sheep, 3,358 ; cattle, 128 ; swine, 28 ; horses (draught), 9. In addition to these draught-horses several shipments of trotters and thoroughbreds were made to Australia for racing purposes, but many of these returned at the conclusion of their engagements.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HEMLOCK AND ITS CONTROL ON THE FARM.

J. A. B., Waikaia :—

I write to ask if you can give me any advice as to how to deal with the hemlock-plant. On a farm I have here (formerly used for dairying) there is a patch of this weed (½ acre or more), which is spreading rapidly, and although it has during the last year been carefully scythed two or three times, yet it seems to be growing more vigorously than ever. My neighbour, a dairy-farmer, says he believes he has lost three or four cows from it, and also thinks it may have been the cause of the death of one or two of his horses. I also have lost two draught horses within the last eighteen months : one was found resting in a hard-bottomed creek—apparently paralysed and unable to rise, and had to be shot ; the other was found dead (showing no signs of struggle). These horses had some time previously access to where the hemlock was growing. I have no evidence of their eating it, but I have wondered if the apparent paralysis in the one might not have been due to the weed. Would the chlorates you now recommend for ragwort be effective with the hemlock ?

The Live-stock Division :—

The poisonous property of hemlock has been well known from time immemorial, but stock, as a rule, do not eat the plant ; it is offensive to them owing to its extremely unpleasant odour. When animals are definitely poisoned by the plant the progress of symptoms is rapid, and death would soon take place. There is generally greatly accelerated breathing, muscular trembling, difficulty in walking, some paralysis, and a low temperature. With regard to the use of sodium chlorate being effective against hemlock, some experiments have recently been conducted in the North Island. The results are to some extent inconclusive, but it would appear that (1) the solution will require to be stronger than that used on ragwort ; (2) that it is more effective on old growth than on new ; and (3) that more than one spraying is necessary to prevent further growth. In your district, so far as poisoning of stock is concerned, one must not lose sight of the probability of ragwort poisoning, the symptoms of which are dopiness, staggering gait, increasing debility, and subsequently blindness ; but these are progressive over a much longer period—often two or three months.

GRASS-SEED MIXTURES FOR BURNS.

F. G. LEWIS, Eketahuna :—

I shall be obliged if you will supply me with a list of grass-seeds and quantities suitable for a bush-burn on a good heavy clay soil, part of which is a hilly face facing north-east and the rest being flat. The ground has been heavily timbered with matai, rimu, white-pine, and tawa chiefly. Secondly, I would like a suitable seed mixture for a hard clay face facing west ; it has never had heavy timber on it, but is being cleared of scrub at the present time.

The Fields Division :—

A mixture suggested for your heavy clay flat is as follows : Italian rye-grass, 4 lb. ; Hawke's Bay perennial rye-grass, 16 lb. ; Akaroa cocksfoot, 6 lb. ; timothy, 2 lb. ; crested dogstail, 2 lb. ; cowgrass, 5 lb. ; white clover, 2 lb. : total, 37 lb. per acre. For the clay face facing north-east the following should be suitable : Italian rye-grass, 4 lb. ; Hawke's Bay perennial rye-grass, 10 lb. ; Akaroa cocksfoot, 8 lb. ; crested dogstail, 3 lb. ; Danthonia pilosa, 3 lb. ; brown-top, 1 lb. ; white clover, 2 lb. : total, 31 lb. per acre. In the case of the hard clay face facing west, where you are at present clearing scrub, and which no doubt you will be surface-sowing on the burn, the following is suggested : Hawke's Bay perennial rye-grass,

12 lb.; Akaroa cocksfoot, 8 lb.; crested dogstail, 3 lb.; Poa pratensis, 1 lb.; brown-top, 1 lb.; Danthonia pilosa, 3 lb.; white clover, 2 lb.: total, 30 lb. per acre. As you are in the vicinity of lime-works, if it is not too costly, you would be well advised to lime the heavy clay to which the first mixture refers, and also to assist the young pasture with a phosphatic manure.

COVER-CROP MANURING AND WEED-CONTROL IN ORCHARD.

"SUBSCRIBER," Auckland:—

Would basic slag be sufficiently quick-acting to sow with a blue-lupin cover-crop in autumn in an orchard? What quantity would be necessary, if it is suitable for the purpose? Owing to the use of superphosphate as a fertilizer in the orchard for the past two years, it is not desired to apply more for the lupins. The soil is gum land, varying from light loam to heavy clay. What is the best method of eradication or control in a 10-acre orchard of strong annual growths of fern, paspalum (which is spreading rapidly), and blackberries?

The Horticulture Division:—

Basic-slag is slow-acting, but the lupin crop takes a long time to develop, and would very possibly benefit from the manure applied. Acid superphosphate is to a great extent wasted on orchards in gum land, unless a dressing of lime is also given. When sowing a green cover-crop in the autumn 2 cwt. to 5 cwt. of a phosphatic manure per acre is applied, according to the conditions. In your case the amount would probably be rather large, but depending on the amounts and results of the previous use of superphosphate. Further advice should be obtained from the district Orchard Instructor. The growth of fern, paspalum, and blackberries should not have any chance of becoming troublesome in a 10-acre orchard under ordinary management. A cover-crop to smother the weeds in autumn, and spring ploughing, with summer cultivation to follow, is the most effective method of controlling weeds that could be devised; but it should be done thoroughly.

AUSTRALIAN CHERRIES.

G. MILLSOM, Blenheim:—

It has been stated in several papers recently that old cherry-trees are being regrafted with new Australian varieties. Further, it is stated that the Australian cherries are better appreciated by the public. Can you tell me the names of these varieties, and the order of bearing.

The Horticulture Division:—

The "Australian cherries" you mention as being popular are the larger mid-season varieties Florence and Black St. Margaret. A popular late variety there is Noble, and of the early varieties Early Lyons and Eagle Seeding are most in favour.

SODIUM CHLORATE FOR RUSHES AND CUTTY-GRASS.

"SUBSCRIBER," Napier:—

Will you kindly inform me whether sodium chlorate would be a suitable spray for killing rushes and cutty-grass. If so, in what proportion for mixing. Is it injurious to sheep or cattle?

The Fields Division:—

Experiments are at present being carried out with sodium chlorate as a means of killing rushes, but are not yet finalized. So far a solution of from 2½ to 3 per cent. appears to be having a favourable result. We have not yet tried sodium chlorate on cutty-grass. This chemical is not injurious to sheep or cattle when sprayed on vegatation in low-percentage solutions.

IMPERIAL AGRICULTURAL BUREAUX AT WORK.

ALL the eight Imperial agricultural bureaux, set up under Imperial control to act as clearing-houses of information for agricultural science, have started work during the past year and are now in full working-order, states the first annual report of the Executive Council, recently issued.

The bureaux are financed out of a common fund, to which England and Wales, Scotland, Northern Ireland, Canada, Australia, New Zealand, South Africa, the Irish Free State, India, Southern Rhodesia, and the Crown colonies contribute. These countries are represented on the Executive Council in London, which is, in fact, a really Imperial secretariat working under the control of nearly all the Empire Governments. The Chairman of the Executive Council is Sir Robert Greig, and the Secretary Sir David Chadwick.

Each bureau is located at a leading research centre in the United Kingdom, and the Director of the institution is in each case Director of the Bureau. The branches of science dealt with are as follows: Soil science (Rothamsted), animal nutrition (Aberdeen), animal health (Weybridge), animal genetics (Edinburgh), animal parasitology (St. Albans), plant genetics (one for crops at Cambridge and one for herbage plants at Aberystwyth), and fruit-production (East Malling).

The functions of the eight bureaux are to collect all information published in any part of the world dealing with their particular sciences. This they translate, catalogue, summarize, and pass on to officers in all parts of the Empire to whom it is of interest. They are also intended to keep kindred workers in different parts of the Empire in touch with each other, and to advise and help overseas officers who are in the United Kingdom on "study leave." They do not undertake research work themselves, but pass on problems to the right centre.

Direct contacts between bureaux officers and oversea workers are fostered, and to this end an officer who has either received part of his early training or has served for some time in some part of the Empire overseas has been selected in almost every case for the post of chief officer under the Director. Official correspondents resident overseas have been nominated during the past year and are now in consultation with the bureaux.

A list of the New Zealand correspondents and their respective bureaux was published in the *Journal* for November, 1929, page 361.

FORTHCOMING AGRICULTURAL SHOWS.

THE following show-dates have been notified by agricultural and pastoral associations:—

Helensville A. and P. Association: Helensville, 29th January, 1931.
Feilding A. and P. Association: Feilding, 3rd and 4th February.
Dannevirke A. and P. Association: Dannevirke, 10th and 11th February.
Masterton A. and P. Association: Solway, 17th and 18th February.
Te Awamutu A. and P. Association: Te Awamutu, 18th February.
Marton A. and P. Association: Marton, 25th February.
Auckland A. and P. Association: Auckland, 26th, 27th, and 28th February.
Katikati A. and P. Association: Katikati, 3rd March.
Taranaki Agricultural Association: New Plymouth, 4th and 5th March.
Waikato Central Agricultural Association: Cambridge, 4th and 5th March.
King Country Central A. and P. Association: Te Kuiti, 12th March.
Mayfield A. and P. Association: Mayfield, 14th March.
Hawke's Bay A. and P. Society: Tomoana (Autumn Show), 18th March.
Methven A. and P. Association: Methven, 28th March.
Oxford A. and P. Association: Oxford, 2nd April.

Foreign Butter-containers.—The Inspector of New Zealand Dairy-produce in London advises that lately Siberia, Poland, and Estonia have been shipping butter in oblong boxes of the New Zealand type.